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A Morphometric Analysis of Geographic Variation within *Sorex monticolus* (Insectivora: Soricidae)

Lois F. Alexander

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21 February 1996

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A Morphometric Analysis of Geographic Variation within *Sorex monticolus* (Insectivora: Soricidae)

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ABSTRACT Shrews previously recognized as *Sorex monticolus* (Insectivora: Soricidae) were classified into two species (one with 14 subspecies, the other monotypic) on the basis of a morphometric analysis of the skulls of 3610 individuals from throughout their range, which extends from northern Alaska to central Mexico. The skulls of *Sorex monticolus*, in general, exhibit relatively little morphometric variation, but among nominate races, there is a general trend of increasing skull length from south to north. Southern subspecies restricted to isolated mountains have the shortest skull lengths of all *S. monticolus*, and subspecies from the northern coastal and insular areas of southeastern Alaska and British Columbia have the longest skulls. Insular and coastal populations of *S. monticolus* have longer skulls than the *S. monticolus* from the interior mainland. Shrews that occur on the mainland and have long skulls (*S. m. longicaudus* and *S. m. alascensis*) also occur on some islands; their mainland distributions are restricted to a narrow band along the coasts of Alaska and British Columbia. Morphometric variation among nominate races is sufficient to warrant continued separation at the subspecies level of all taxa except *S. m. calvertensis* and *S. m. elassodon*. Were it not for differences in pelage color, based on my morphometric analysis, *S. m. calvertensis* and *S. m. elassodon* should be synonymized. *Sorex m. neomexicanus*, which occurs in the Sacramento and Capitan mountains of New Mexico, previously was recognized as a subspecies of *S. monticolus*, but is recognized herein as a distinct species.

Key words: Sorex monticolus; Soricidae; Geographic variation; Morphometrics; Taxonomy.

INTRODUCTION

The dusky or montane shrew, *Sorex monticolus*, ranges from northern Alaska to northern Mexico and from the Pacific Coast to northwestern Saskatchewan and eastern Alberta, Montana, Wyoming, Colorado, and New Mexico. Trinomials have been applied to insular populations of coastal Alaska and Canada (including *calvertensis, elassodon, insularis, isolatus, malitiosus,* and *prevostensis*), and to relictual montane populations in the southwestern United States and Mexico (*monticolus, neomexicanus,* and *parvidens*) and central Saskatchewan and western Manitoba (*soperi*). One subspecies, *S. monticolus obscurus*, occurs from northeastern Alaska to central Mexico. In addition, *S. m. setosus* occurs in western Oregon, Washington, and British Columbia; *S. m. shumaginensis, S. m. alascensis,* and *S. m. longicaudus* occur in western Alaska, along the southern coast of Alaska, and along the southeastern coast of Alaska and coastal British Columbia, respectively. All of these populations probably were derived from an *obscurus*-like ancestor in the Rocky Mountains (Hennings and Hoffmann, 1977). Findley (1955) also indicated that these were offshoots from a main Rocky Mountain population, but he considered them subspecies of *S. vagrans*. Findley (1955) included *longiquus* and *obscuroides* as separate subspecies (of *S. vagrans*), but Hennings and Hoffmann (1977:15) classified these as "no more than a cluster of ecotypic variants of *S. monticolus obscurus*."

The nominate form, *Sorex monticolus monticolus*, was described by Merriam (1890) as *Sorex monticolus*. Without comment, Merriam (1895) redesignated it *S. vagrans monticola*. This taxon is restricted to the southwestern United States; the type specimen was collected in Arizona. *Sorex monticolus obscurus* was described by Merriam (1891) as *Sorex vagrans similis;* however, the name *similis* was preoccupied by *Sorex similis* Hensel, 1855 (= *Neomys similis*). In 1895, Merriam renamed it *Sorex obscurus*. The type specimen for this taxon was collected in Idaho. *Sorex monticolus setosus* was described originally as a separate species (*Sorex setosus*) from Washington by Elliot (1899); Jackson (1918) redesignated it *S. obscurus setosus* without comment. The currently recognized subspecies—*S. m. alascensis, S. m. calvertensis, S. m. insularis, S. m. isolatus, S. m. longicaudus, S. m. malitiosus, S. m. mixtus, S. m. neomexicanus, S. m. parvidens,* and *S. m. soperi*—all were described originally as subspecies of *S. obscurus* (Anderson and Rand, 1945; Bailey, 1913; Cowan, 1941; Hall, 1938; Jackson, 1919, 1921, 1922; Merriam, 1895). Both *S. m. elassodon* and *S. m. prevostensis,* however, were described originally as subspecies of *Sorex longicauda* by Osgood (1901). Merriam (1895; 1900) referred to *S. obscurus longicauda* in text as *S. longicauda*, presumably shorthand for *S. o. longicauda*. Osgood (1901) seemingly interpreted Merriams' (1895,

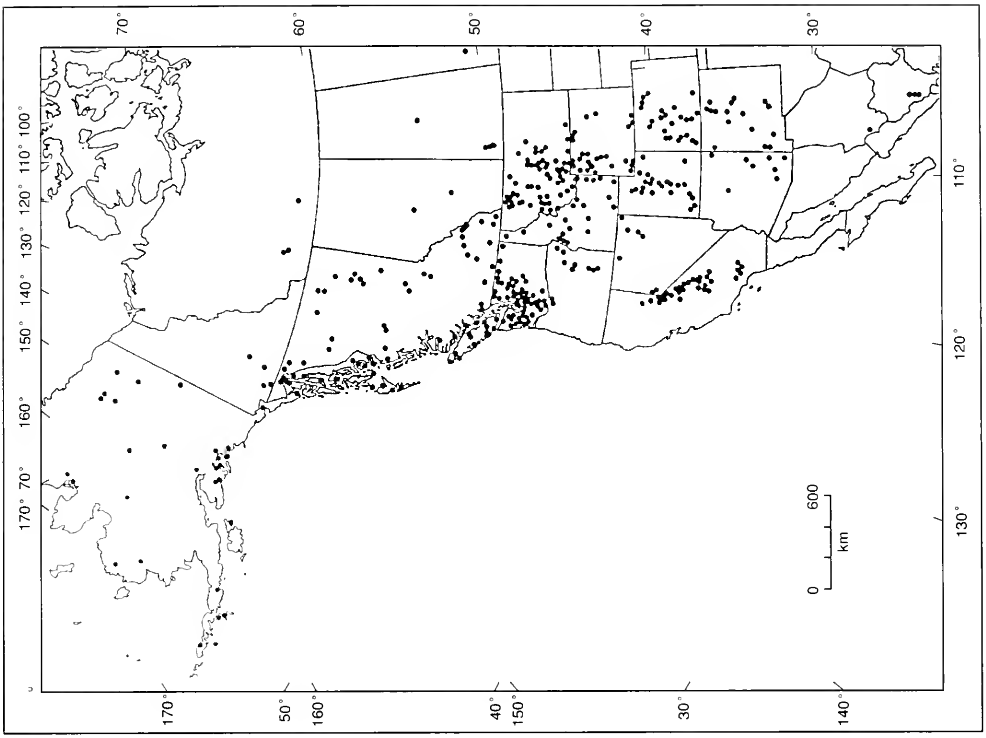
1900) references to mean *S. o. longicauda* had been raised to the specific level, and described *S. m. elassodon* and *S. m. prevostensis* as subspecies of *S. longicauda*. In 1905, Elliot redesignated *S. m. elassodon* and *S. m. prevostensis* as subspecies of *S. obscurus*. Similarly, *S. m. alascensis* was described originally by Merriam (1895) as a subspecies of *S. obscurus*, whereas *S. m. shumaginensis* was described by Merriam (1900) as a subspecies of *Sorex alascensis*. *Sorex o. alascensis* was referred to in text by Merriam (1895) as *S. alascensis*, thereby raising *S. o. alascensis* to the specific level; in 1900, he named *S. alascensis shumaginensis*. Allen (1902) renamed the latter taxon *S. obscurus shumaginensis*. By 1945, after the description of *S. o. soperi* by Anderson and Rand (1945), what is recognized currently as *Sorex monticolus* consisted of *S. obscurus* (with 15 subspecies), and a subspecies of *S. vagrans* (*S. vagrans monticola*).

A taxonomic revision of the shrews in the "*Sorex vagrans* species complex" redesignated the subspecies of *S. monticolus* as subspecies of *S. vagrans* (Findley, 1955). Findley (1955) believed that *S. vagrans* and *S. monticolus* were not reproductively isolated throughout the range, but where sympatric, did not interbreed because they were the overlapping ends of a rassenkreis. With this revision, *S. monticolus monticolus* remained *S. vagrans monticola*, *S. obscurus* became *S. vagrans obscurus*, and all the taxa described as subspecies of *S. obscurus* kept their trinomial, but became subspecies of *S. vagrans*. Johnson and Ostenson (1959) disagreed with Findley's (1955) revision and stated that until a more detailed study was accomplished, the taxonomy should remain as described by Jackson (1928), who separated *S. vagrans* from *S. obscurus* (= *monticolus*) on the basis of size (total length > 110 mm in *obscurus* and < 110 mm in *vagrans*) recognizing both as species. Hennings and Hoffmann (1977) showed that *S. vagrans* and *S. monticolus* could be separated on the basis of the structure of the medial tines on the first upper incisors (I1), the height of red pigmentation on the anterior face of I1 in relation to the medial tines, and by limited skull morphometrics. These authors considered *S. vagrans monticola* to be *S. obscurus monticolus*. Hennings and Hoffmann (1977) resurrected the name with priority, *S. monticolus*. Without explanation of differences among them, they further divided *S. monticolus* into 18 subspecies, seemingly based on geography and acceptance of previous trinomials. A multivariate morphometric analysis of the "*Sorex vagrans* species complex" in the Pacific Coast region indicated to Carraway (1990) that *S. m. bairdi* and *S. m. permiliensis* were specifically different from *S. m. setosus* and *S. m. obscurus*; she resurrected *S. bairdii* [sic]. George and Smith (1991) considered *S. m. mixtus* to be synonymous with *S. m. setosus*; they recognized *S. m. setosus* and *S. m. isolatus* as distinct taxa. Distribution of localities for specimens examined in these three studies combined included 791 distinct localities (Fig. 1).

Sorex monticolus commonly occurs in high altitude spruce (*Picea*)-fir (*Abies*) forests and alpine tundra, and in mid-altitude Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), western larch (*Larix* sp.), and grand fir (*Abies grandis*) forests (Hennings and Hoffmann, 1977). The patchy occurrence of these habitat types possibly explains the apparently patchy distribution of *S. monticolus*. Hennings and Hoffmann (1977) indicated that during the Wisconsin glacial period *S. monticolus* inhabited continuous boreal-forest corridors that included mountainous regions such as the Sierra Nevada, San Bernardino, Piute, and Tehachapi mountains, and mountains in northern Mexico. Today, however, many of these highland habitats, and the shrews that inhabit them, are completely isolated.

From color and cranial characters, Jackson (1928) indicated that *Sorex monticolus* contains many intergrades; however, this was based on qualitative observations. Findley's (1955) classification of the "*Sorex vagrans* species complex" was based on overall size and color. Later studies, including that of Hennings and Hoffmann (1977), were based on qualitative characters or on univariate to trivariate quantitative comparisons. The geographic variation of *Sorex monticolus* has not been assessed previously by quantitative multivariate analyses.

The objectives of my research were to evaluate and describe the geographic variation within *Sorex monticolus* in the western United States, Canada, and Mexico, and to consider the appropriateness of



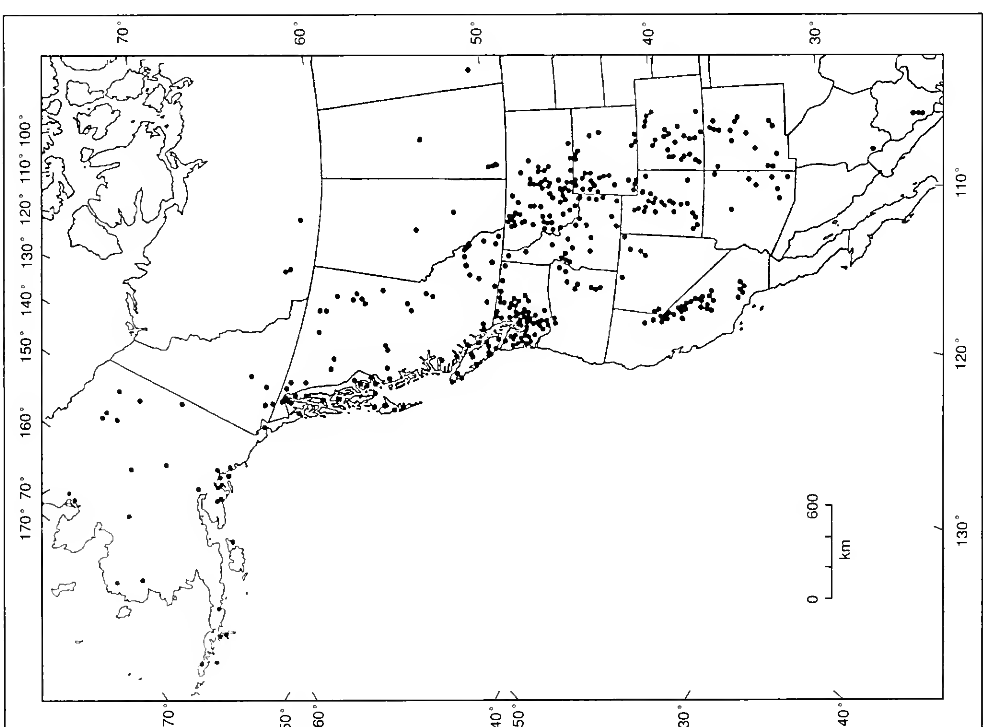


Fig. 1. **Left:** Distribution of 791 unique localities for specimens used to establish current taxonomy of *Sorex monticolus*, based on Carraway (1990), George and Smith (1991), Hall (1981), and Hennings and Hoffmann (1977). **Right:** 1336 unique localities for *Sorex monticolus* specimens included in this morphometric analysis.

current taxonomy applied to geographic variants. Many new specimens have become available since Hennings and Hoffmann's (1977) preliminary assessment of this group. My research represents the first comprehensive quantitative analysis of geographic variation in *Sorex monticolus*. A better understanding of the systematic relationships of these shrews is essential for studies of ecological relationships in small-mammal communities and studies of relictual mammal populations.

MATERIALS AND METHODS

Skulls (and skins when available) of 3610 *Sorex monticolus* (sensu Hennings and Hoffmann, 1977, which includes *Sorex obscurus*, *Sorex vagrans monticola*, *Sorex vagrans obscurus*, and *Sorex bairdi*) from 1336 unique localities were examined and measured (Fig. 1). Individuals were identified to species by tooth characteristics as described by Carraway (1990) and Hennings and Hoffmann (1977). Only undamaged skulls of adults, having slight but not excessive tooth wear (Jackson, 1928), were measured.

An ocular micrometer mounted in a Bausch and Lomb binocular microscope was used to measure 17 cranial and mandibular characters (Fig. 2). A Fowler Max-Cal electronic caliper with digital readout to 0.01 mm was used to measure cranial depth and greatest length of skull. These 19 characters were selected because they are conventional dimensions found useful in previous studies of soricids (Carraway, 1990; Choate, 1972; Diersing, 1980; van Zyll de Jong, 1980) and because they have objective endpoints and are consistently repeatable. Values for characters measured with the ocular micrometer were retained as number of ocular lines for analysis; values subsequently were converted to millimeters and are reported as such herein. Gender in *Sorex* does not seem to affect cranial morphology (Rudd, 1955; van Zyll de Jong, 1980); in addition, many (≥10%) museum specimens of shrews are misclassified to sex (L. Carraway, pers. comm.) thus biasing results claiming a difference. For these reasons sexes were combined in this analysis.

Sorex bairdi bairdi and *Sorex bairdi permiliensis* were recognized previously as subspecies of *S. monticolus* (*S. monticolus bairdi* and *S. monticolus permiliensis*—Hennings and Hoffmann, 1977). Subsequently, Carraway (1990) indicated that these taxa are specifically different from *S. monticolus*. This separation was tested by use of multigroup discriminant-functions analysis (BIOΣTAT II—Pimentel and Smith, 1986).

A priori groups within *Sorex monticolus* were established primarily by use of currently accepted taxonomy. A priori groups consisted of *alascensis*, *calvertensis*, *elassodon*, *insularis*, *isolatus*, *longicaudus*, *malitiosus*, *monticolus*, *neomexicanus*, *obscurus*, *prevostensis*, *setosus*, and *shumaginensis*. I was unable to obtain a sufficiently large sample to include *S. m. parvidens* ($n = 6$) or *S. m. soperi* ($n = 1$) as a priori groups, thus, these groups were excluded from the initial analyses. I included *S. m. obscuroides* ($n = 116$) as a separate a priori group because this taxon was recognized previously as a subspecies of *S. vagrans* (=*S. monticolus*) by Findley (1955) and is geographically isolated. A reexamination of its relationship to the remaining taxa within the group was considered appropriate.

Straight-line polygons were drawn around the published marginal records (Hall, 1981; Hennings and Hoffmann, 1977) for each subspecies to form the 14 a priori groups (Fig. 3). Specimens from localities within a polygon were considered to belong to the taxon for which marginal records were used to produce that polygon. Specimens from localities outside of polygons ($n = 107$) were not included in the initial analyses, but were assigned to their appropriate groups by use of diagnosis files created with two- or three-group discriminant analyses between geographically adjacent a priori groups. Because Carraway (1990) considered *S. bairdi* a distinct species, and my results corroborated this, *S. bairdi* ($n = 110$) was used as an outgroup.

Univariate summary statistics for all measurements were calculated for each group by use of basic descriptive statistics available in STATGRAPHICS (Statistical Graphics Corporation, 1987), and the corresponding coefficients of varia-

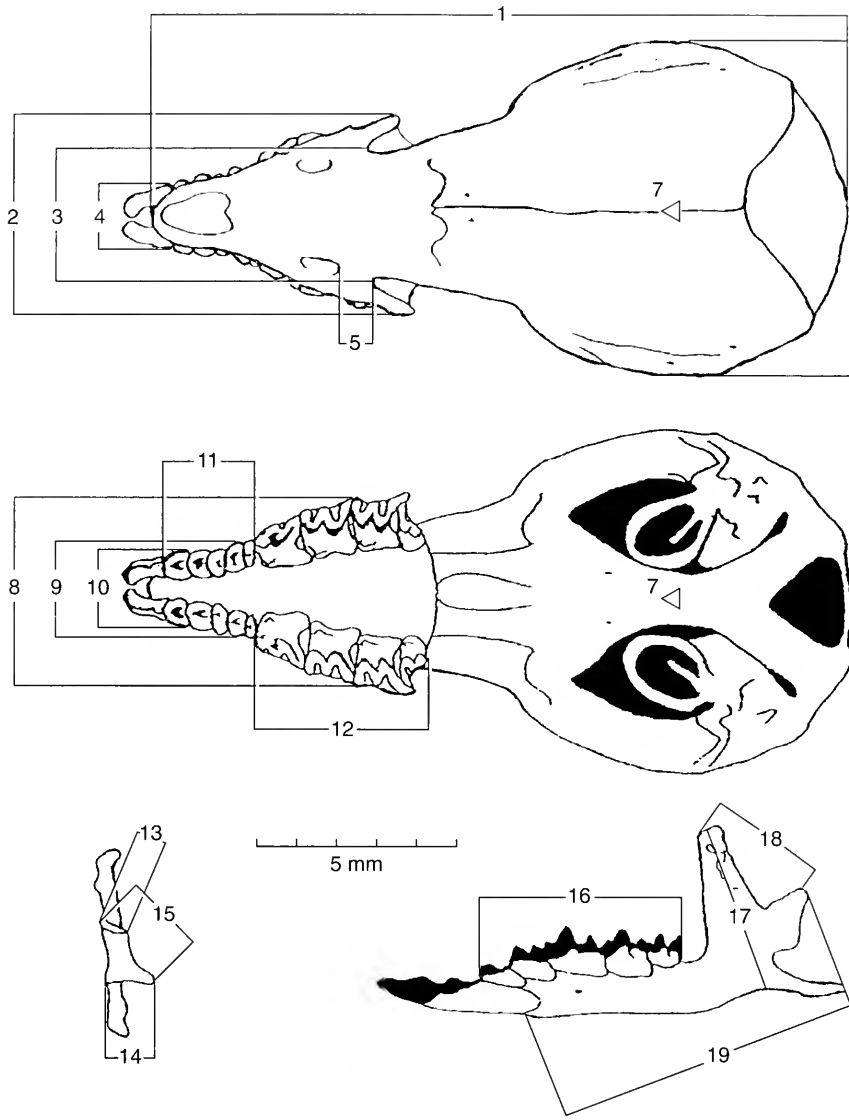


Fig. 2. Skull and mandible of *Sorex monticolus* (MSB 1944) illustrating dimensions measured (after van Zyll de Jong, 1980:67, fig. 1 and Carraway, 1990:11, fig. 4): 1 = greatest length of skull (GLSKL); 2 = maxillary breadth (MXBR); 3 = least interorbital breadth (LIOB); 4 = width across I1-I1 (I1I1); 5 = breadth of zygomatic plate (ZYGP); 6 = cranial breadth (CRBR); 7 = cranial depth (CRDP); 8 = breadth at M2-M2 (M2M2); 9 = breadth at U4-U4 (U4U4); 10 = breadth at U1-U1 (U1U1); 11 = length of unicuspid toothrow (LUTR); 12 = length of P4-M3 (P4M3); 13 = width of upper condylar facet (WUCF); 14 = width lower condylar facet (WLCF); 15 = greatest condylar depth (GCDP); 16 = length of mandibular toothrow (LMTR); 17 = height of coronoid process (CORH); 18 = coronoid process-condylar length (CCLG); 19 = length of mandible (LGMN).

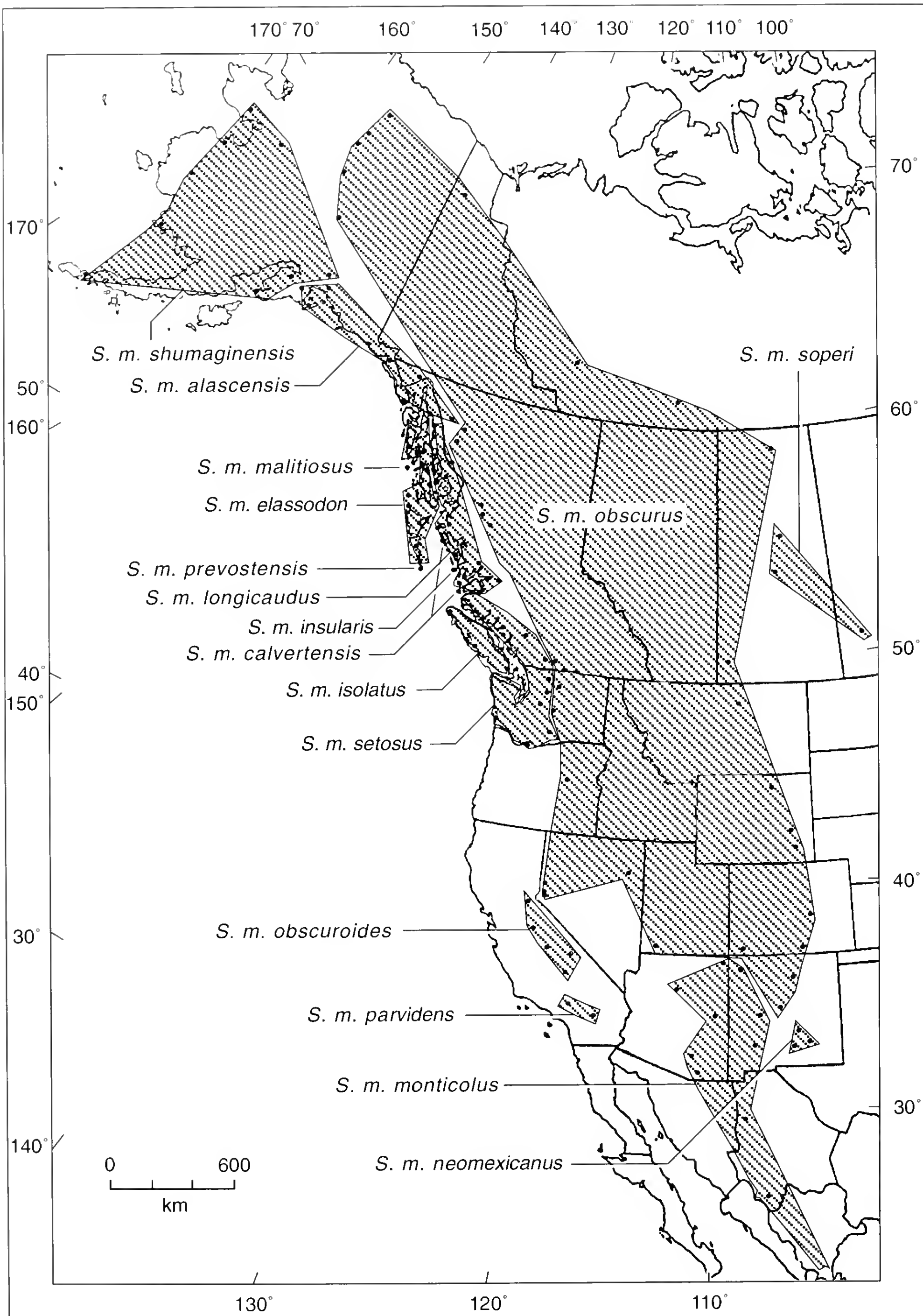


Fig. 3. Map of marginal-record polygons for 14 subspecies of *Sorex monticolus* used as a priori groups in the present morphometric analysis. Marginal records based on Hall (1981) and Hennings and Hoffmann (1977).

tion for each variable were compared. Multivariate analyses were performed on cranial and mandibular data for each group by use of the programs for principal-components analysis, multigroup discriminant-functions, and principal-coordinate analyses in BIOΣTAT II (Pimentel and Smith, 1986); and multigroup discriminant-functions, covariance, and eigen-analyses were performed in STATGRAPHICS (Statistical Graphics Corporation, 1987). Principal-coordinate analysis was used to validate the results of the discriminant-functions analysis. Generalized-distance matrices derived from character means for each group, generated by the discriminant-functions analyses, were used in cluster analyses (unweighted pair-group method by use of arithmetic average) of the 14 a priori groups and in the three-group species-level analysis by use of BIOΣTAT II (Pimentel and Smith, 1986). Plotting options were performed by use of STATGRAPHICS (Statistical Graphics Corporation, 1987), Corel Draw (Corel Corporation, 1992), and QuickBASIC graphics options (Microsoft Corporation, 1988). A probability level of $P \leq 0.05$ was accepted as statistically significant for all analyses.

Covariance and eigen-analyses were performed on the canonical-variate scores for each group to generate eigenvectors and eigenvalues (Statistical Graphics Corporation, 1987) used to calculate 95% confidence ellipses around group centroids. The first and second eigenvalues and n were used to calculate the half-lengths for the major and minor axes. The focal length for each ellipse is the square root of the difference between the two squared half-lengths. The arc cosine of the first element of the first eigenvector equals the slope of the major axis (Owen and Chmielewski, 1985).

Systematic accounts contain the original taxonomic designation, new name combinations, and junior synonyms where appropriate. In specimens-examined lists (Appendix), specimens, as classified by my analyses, are ordered alphabetically by state, county, major geographic point in specific locality, and museum acronym, and numerically by catalog number. Specimens from localities not marked on distribution maps are marked with an asterisk in the appropriate specimens-examined list. Type specimens are marked with a dagger (†). On distribution maps, many locality symbols cover more than one unique locality. Instead of presenting subspecies as wholly separate units, I attempt to describe the regions of intergradation between adjacent subspecies. Regions where two taxa come together were considered zones of intergradation between subspecies because the shrews from these regions typically had weak classifications. Such individuals are included in the specimens-examined list of the taxon with which they had the strongest affinities.

RESULTS

A comparison of all 19 cranial and mandibular characters for each a priori group indicated that for width of the upper condylar facet the coefficient of variation was nearly twice that of all other characters. Because this character exhibited so much variation within each group, it seemed of limited value for distinguishing between groups and was deleted from all further analyses.

Species-Level Analysis

Univariate Student-Newman-Keuls multiple-range tests for *Sorex bairdi* (n = 110) and *S. monticolus* (n = 3500) resulted in a significant difference between means of all characters analyzed. *Sorex bairdi* averaged larger than *S. monticolus* in all characters measured; however, there was significant overlap of ranges. In a discriminant analysis between these two taxa, the group centroids were significantly different (F-ratio = 145.191, Wilks l = 0.5787787; df = 18, 3,591) and 99% of the individuals were correctly classified into their a priori groups (Fig. 4A). Twenty-two *S. bairdi* and eight *S. monticolus* were misclassified. Characters with the highest positive coefficients of correlation to the first canonical-variate were height of coronoid process (0.792), breadth at U4-U4 (0.701), length of mandible (0.644), and coronoid process-condylar length (0.610). The Mahalanobis' distance between these two groups was 4.962.

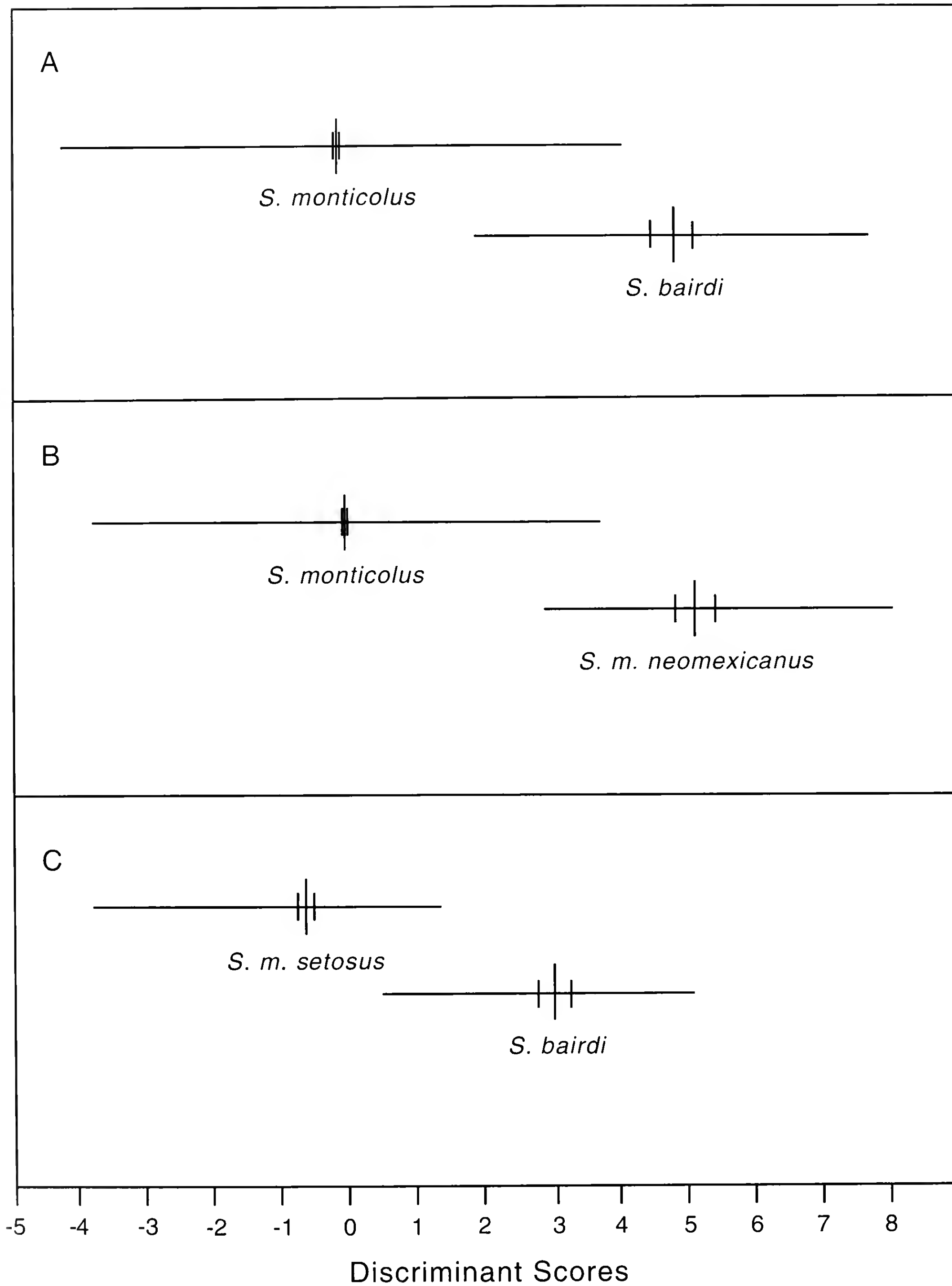


Fig. 4. Means, 95% confidence intervals, and ranges of discriminant scores for two-group discriminant analyses with (**A**) *Sorex bairdi* and *S. monticolus,* (**B**) *S. m. neomexicanus* and the remaining subspecies of *S. monticolus,* and (**C**) *S. bairdi* and *S. m. setosus* with three characters.

Variation Within *Sorex monticolus*

Principal-components analysis was performed on each of the a priori groups within *Sorex monticolus* to determine if variation within any one group was greater than expected for one taxon. The first two components for each group were examined for possible outliers and for an indication that any of the a priori groups should be separated into more than one group. All a priori groups remained as grouped.

A 15-group discriminant analysis with the 14 a priori *Sorex monticolus* groups and *S. bairdi* resulted in a 67% overall correct classification of individuals. The first two canonical variates accounted for 73.87% (46.59% and 27.28%, respectively) of the among-group variation within the 18 remaining cranial and mandibular characters examined (Fig. 5). Characters with the highest positive coefficients of correlation to the first canonical-variate axis were greatest length of skull (0.847) and length of unicuspid toothrow (0.518). Characters with the highest positive coefficients of correlation to the second canonical-variate axis were height of the coronoid process (0.845), breadth at U1-U1 (0.688), breadth at U4-U4 (0.639), and coronoid process-condylar length (0.616). A principal-coordinate analysis of the generalized-distance matrix derived from character means resulted in a distribution of group means on the first two coordinates consistent with the results of the discriminant analysis. A cluster analysis of the generalized-distance matrix resulted in a distance phenogram (Fig. 6) that indicated that *S. m. neomexicanus* is morphologically distinct from the other 13 a priori groups at Mahalanobis' distance 4.836. Both the 95% confidence ellipses (Fig. 5) and the distance phenogram (Fig. 6) indicated that *S. m. neomexicanus* is at least as distinct morphometrically as *S. bairdi* from *S. monticolus*. In addition, in the *S. bairdi* and *S. monticolus* discriminant analysis, all eight of the individuals from the *S. monticolus* group that were misclassified were from the subspecies *S. m. neomexicanus*. Another four (8.7%) of the 46 *S. m. neomexicanus* had Geisser-probability classifications < 80%; 10 (22%) had classification probabilities < 60%. Of all remaining *S. monticolus* (n = 3454) only 10 individuals had a classification probability < 90%. The poor classification of individuals within the *S. m. neomexicanus* a priori polygon indicated that further analysis of *S. m. neomexicanus* was appropriate. Another species-level discriminant-functions analysis was performed for *S. m. neomexicanus* and the other subspecies of *S. monticolus* (n = 3454).

Univariate Student-Newman-Keuls multiple-range tests for *Sorex monticolus neomexicanus* and all other subspecies of *S. monticolus* resulted in a significant difference between means for all characters analyzed. *Sorex m. neomexicanus* averaged larger than other subspecies of *S. monticolus* in all characters measured; however, ranges overlapped significantly (Table 1). In a discriminant analysis between *S. m. neomexicanus* and the remaining subspecies of *S. monticolus*, group centroids were significantly different (F-ratio = 66.537, Wilks l = 0.7440163; df = 18, 3,481). The Geisser-classification probabilities resulted in the correct classification into their a priori groups of all but two *S. m. neomexicanus*, and one of the remaining *S. monticolus* (Fig. 4B). Characters with the highest positive coefficients of correlation to the first canonical-variate axis were breadth at U1-U1 (0.732), height of coronoid process (0.594), length of unicuspid toothrow (0.565), and breadth at U4-U4 (0.556). The Mahalanobis' distance between these two groups was 5.149. *Sorex m. neomexicanus* was not included in subsequent analyses of geographic variation within *S. monticolus*.

A multigroup discriminant analysis with the 13 remaining a priori *Sorex monticolus* groups resulted in a 67% overall correct classification of individuals. The first two canonical variates accounted for 76.17% (60.94% and 15.23%, respectively) of the among-group variation within the 18 remaining cranial and mandibular characters examined (Fig. 7A). The character with the highest positive coefficient of correlation to the first canonical-variate axis was greatest length of skull (0.760); all remaining characters had correlation coefficients < 0.400. Characters with the highest positive coefficients of correlation to the second canonical-variate axis were length of unicuspid toothrow (0.720), cranial breadth (0.565), breadth of zygomatic plate (0.525), and length of mandibular toothrow (0.504). The first canonical variate

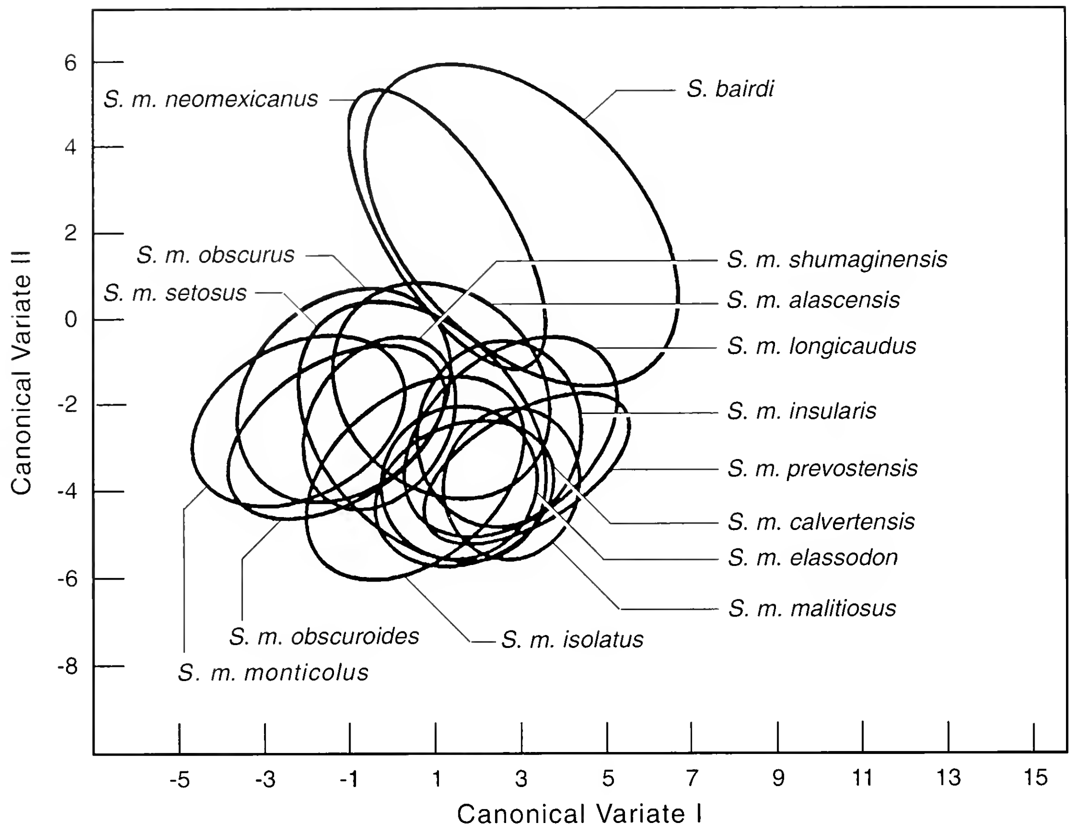


Fig. 5. Confidence ellipses (95%) for all 14 a priori *Sorex monticolus* groups and *S. bairdi*.

apparently represents overall size variation, whereas the second canonical variate represents variation in shape. A cluster analysis of the generalized-distance matrix derived from character means resulted in a distance phenogram (Fig. 8A) that demonstrates a separation of the 13 a priori groups into two large clusters at Mahalanobis' distance 3.855. *Sorex m. obscurus* and *S. m. obscuroides* clustered together at Mahalanobis' distance 1.472 and seem to be similar morphologically (Fig. 7B). *Sorex m. obscuroides* was grouped with *S. m. obscurus* in further analyses. *Sorex m. calvertensis* and *S. m. elassodon* cluster together at Mahalanobis' distance 1.226; these groups also seem to be similar morphologically (Fig. 7C). Both summer and winter pelages of *S. m. calvertensis* (from both Calvert and Banks islands, British Columbia), however, are much paler than those of either *S. m. elassodon* or *S. m. longicaudus* (Cowan, 1941). Pelage color was noted, but not measured quantitatively in my study. Because of the small sample size for *S. m. calvertensis* (n = 26), it seemed prudent to be conservative, so *S. m. calvertensis* was retained as a separate a priori group for the remaining analyses. A biochemical analysis of the shrews currently designated *S. m. calvertensis, S. m. elassodon*, and *S. m. longicaudus* may be needed to decipher these relationships.

Many misclassified individuals in the 13-group discriminant analysis were classified with groups from geographically distant areas, consequently these affiliations probably have no biological meaning (e.g., specimens from British Columbia being more similar to groups in Arizona than to groups adjacent geographically). Because of the number of groups involved and the similarity of some geographically distant groups, the overall classification of individuals was expectedly poor. Thus,

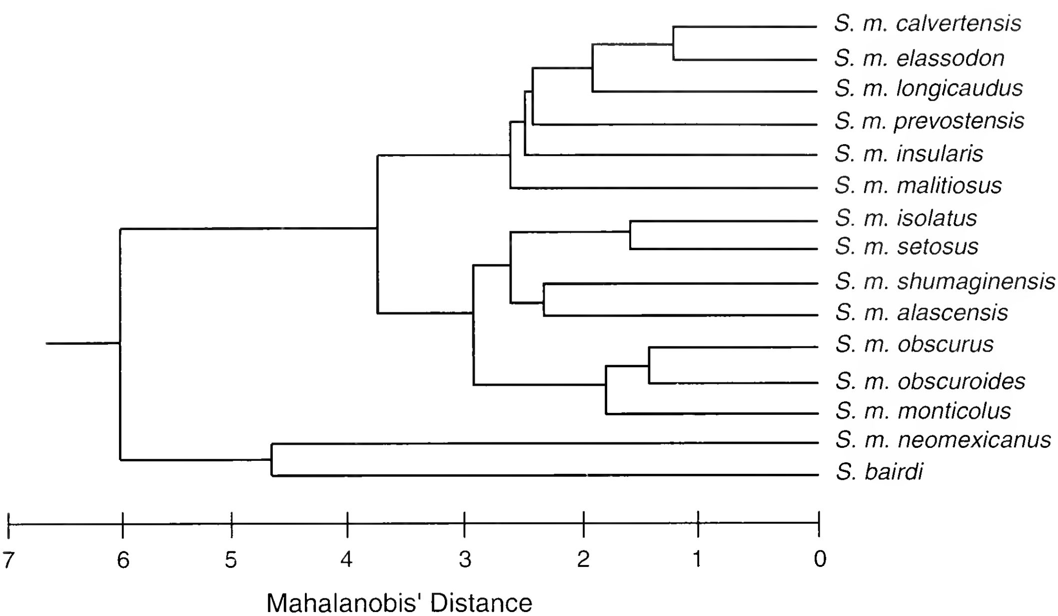


Fig. 6. A dendogram generated by a cluster analysis based on the generalized-distance matrix derived from the 15-group discriminant analysis for *Sorex bairdi* and *S. monticolus*.

two- or three-group discriminant analyses with geographically adjacent a priori groups were performed to obtain diagnosis files to increase the probability of assigning specimens not in a priori groups to their proper groups (Table 2).

Of those specimens outside polygons for *Sorex monticolus shumaginensis*, *S. m. alascensis*, and *S. m. obscurus*, one individual from Glenn Hwy, near Eureka Lodge, Alaska, was approximately equidistant among them. A three-group discriminant analysis was performed to obtain a diagnosis file. The discriminant analysis resulted in 89% correct classification of individuals into their a priori groups and indicated that the unknown individual should be classified as *S. m. obscurus*.

Some individuals misclassified in the two- and three-group discriminant analyses were examined more closely to determine if their group designation should be changed. In the discriminant analysis of *Sorex monticolus monticolus* and *S. m. obscurus*, 16 of 18 individuals in the *S. m. monticolus* a priori group from New Mexico and all six of the individuals from Mexico were misclassified as *S. m. obscurus*. The specimens from Mexico had classification probabilities ≥ 83% and 10 of 16 misclassified individuals from New Mexico had classification probabilities ≥ 80%. Within the Arizona specimens from the *S. m. monticolus* a priori group, 12 of 13 individuals from the northeastern portion of the state (northern Apache Co. and Coconino Co.) were misclassified as *S. m. obscurus*; eight of these 12 had classification probabilities ≥ 72%. These misclassifications indicated that individuals in northeastern Arizona, western New Mexico, and Mexico should be considered *S. m. obscurus* and were so classified for further analyses.

In the discriminant analysis of *Sorex monticolus alascensis* and *S. m. obscurus*, all 11 individuals from Tats Lake, British Columbia, were misclassified as *S. m. obscurus*; 10 of 11 had classification probabilities ≥ 74% and one individual had a classification probability of 63%. Tats Lake is on the northern edge of the previously recognized distribution of *S. m. alascensis* and is adjacent to the range of *S. m. obscurus*. High Geisser classifications and absence of individuals classified as *S. m. alascensis* from this locality indicate that instead of

Table 1. Mean ± SE, range, and CV of 18 cranial and mandibular characters (in mm) for all taxa included in analyses. Sample size (n) in parenthesis.

Character	*S. m. alascensis* (n = 252)	*S. m. calvertensis* (n = 26)	*S. m. elassodon* (n = 178)	*S. m. insularis* (n = 54)	*S. m. isolatus* (n = 152)	*S. m. longicaudus* (n = 253)	*S. m. malitiosis* (n = 17)	*S. m. monticolus* (n = 120)
Maxillary breadth	5.07 ± 0.01 4.57–5.71 4.28	4.85 ± 0.03 4.57–5.29 2.88	4.85 ± 0.01 4.29–5.29 3.43	5.18 ± 0.02 4.57–5.43 3.00	4.76 ± 0.01 4.14–5.29 4.05	5.10 ± 0.01 4.71–5.57 3.43	5.03 ± 0.03 4.86–5.29 2.14	4.72 ± 0.01 4.29–5.00 3.32
Least interorbital breadth	3.68 ± 0.01 3.43–4.00 3.95	3.63 ± 0.02 3.29–3.86 3.37	3.59 ± 0.01 3.14–4.00 3.98	3.72 ± 0.01 3.43–3.86 2.89	3.49 ± 0.01 3.14–4.00 4.31	3.71 ± 0.01 3.43–4.00 3.35	3.74 ± 0.02 3.57–3.86 2.78	3.50 ± 0.01 3.29–3.71 3.59
Cranial breadth	8.81 ± 0.02 8.14–9.86 3.97	8.31 ± 0.03 8.00–8.57 1.93	8.34 ± 0.02 7.71–9.00 2.69	8.64 ± 0.02 8.29–9.14 2.10	8.24 ± 0.01 7.71–8.71 2.23	8.65 ± 0.01 8.00–9.43 2.36	8.54 ± 0.04 8.29–8.86 1.73	8.32 ± 0.02 7.57–8.71 3.08
Breadth of zygomatic plate	2.08 ± 0.01 1.86–2.57 6.23	1.93 ± 0.02 1.86–2.14 4.80	1.91 ± 0.01 1.71–2.14 5.20	1.90 ± 0.01 1.71–2.14 4.61	1.85 ± 0.01 1.43–2.14 5.67	1.98 ± 0.01 1.71–2.29 5.46	1.93 ± 0.03 1.71–2.14 6.46	1.96 ± 0.01 1.71–2.14 5.04
Breadth at M2-M2	4.63 ± 0.01 4.29–5.14 4.03	4.44 ± 0.06 4.29–5.86 7.05	4.35 ± 0.01 4.00–4.71 3.12	4.62 ± 0.02 4.00–4.86 3.00	4.30 ± 0.01 3.86–4.71 4.33	4.60 ± 0.01 4.14–4.86 2.77	4.55 ± 0.03 4.43–4.86 2.77	4.35 ± 0.01 4.00–4.57 3.06
Breadth at U1-U1	1.85 ± 0.01 1.57–2.14 5.60	1.70 ± 0.01 1.57–1.71 2.28	1.70 ± 0.01 1.57–1.86 4.12	1.84 ± 0.01 1.57–2.00 4.17	1.68 ± 0.01 1.43–1.86 4.90	1.82 ± 0.01 1.71–2.00 4.07	1.76 ± 0.02 1.71–1.86 3.82	1.74 ± 0.01 1.57–1.86 4.31
Breadth at U4-U4	2.32 ± 0.01 2.00–2.57 4.71	2.21 ± 0.02 2.00–2.43 4.18	2.21 ± 0.01 2.00–2.43 3.83	2.42 ± 0.01 2.29–2.57 2.80	2.18 ± 0.01 2.00–2.71 4.62	2.36 ± 0.01 2.14–2.57 4.24	2.30 ± 0.01 2.29–2.43 2.06	2.19 ± 0.01 2.00–2.43 3.92
Width across I1-I1	1.57 ± 0.01 1.29–1.86 7.18	1.48 ± 0.02 1.29–1.57 6.14	1.46 ± 0.01 1.29–1.57 5.72	1.58 ± 0.01 1.43–1.71 6.44	1.44 ± 0.01 1.29–1.57 5.70	1.58 ± 0.01 1.43–1.86 5.96	1.59 ± 0.02 1.43–1.71 4.36	1.49 ± 0.01 1.29–1.57 5.78

Length of P4-M3	4.20 ± 0.01 3.86–4.71 4.54	4.14 ± 0.02 4.00–4.29 2.18	4.07 ± 0.01 3.86–4.29 2.72	4.16 ± 0.01 4.00–4.29 2.14	3.90 ± 0.01 3.43–4.14 3.56	4.25 ± 0.01 4.00–4.57 2.57	4.15 ± 0.03 4.00–4.43 3.09	3.89 ± 0.01 3.43–4.29 3.56
Length of unicuspid toothrow	2.63 ± 0.01 2.29–3.14 5.30	2.44 ± 0.01 2.29–2.57 2.83	2.41 ± 0.01 2.14–2.57 3.68	2.51 ± 0.01 2.43–2.71 3.44	2.38 ± 0.01 2.00–2.57 4.24	2.59 ± 0.01 2.29–2.86 3.94	2.51 ± 0.02 2.43–2.57 2.88	2.26 ± 0.01 2.14–2.43 4.50
Cranial depth	5.16 ± 0.02 4.38–6.03 5.36	4.99 ± 0.05 4.41–5.42 4.84	5.00 ± 0.02 4.36–5.72 5.50	5.14 ± 0.03 4.55–5.53 4.52	4.93 ± 0.02 4.14–5.74 5.95	5.19 ± 0.02 4.45–5.81 5.20	4.83 ± 0.03 4.52–5.05 2.97	4.70 ± 0.02 4.11–5.15 4.88
Greatest length of skull	17.81 ± 00.02 16.43–18.89 2.08	17.86 ± 00.06 17.25–18.33 1.76	17.78 ± 00.03 16.95–18.83 2.05	18.05 ± 00.04 17.51–18.89 1.60	17.27 ± 00.03 15.83–18.33 2.50	18.38 ± 00.02 17.46–19.34 1.91	18.07 ± 00.09 17.44–18.96 2.10	16.38 ± 00.03 15.31–17.22 1.93
Length of mandible	8.30 ± 0.02 7.43–9.29 4.18	7.81 ± 0.04 7.43–8.29 2.69	7.86 ± 0.02 7.14–8.57 3.03	8.04 ± 0.03 7.57–8.57 2.77	7.78 ± 0.02 7.00–8.43 3.66	8.21 ± 0.02 7.57–9.14 3.31	8.24 ± 0.05 7.86–8.57 2.74	7.66 ± 0.03 6.71–8.57 4.26
Length of mandibular toothrow	5.19 ± 0.01 4.86–5.71 3.90	4.97 ± 0.02 4.86–5.29 2.04	4.94 ± 0.01 4.57–5.29 2.44	5.11 ± 0.01 5.00–5.29 1.93	4.79 ± 0.01 4.43–5.14 3.19	5.20 ± 0.01 4.71–5.57 2.63	5.09 ± 0.03 4.86–5.29 2.20	4.73 ± 0.01 4.29–5.14 3.51
Height of coronoid process	4.05 ± 0.01 3.71–4.57 5.01	3.72 ± 0.02 3.57–3.86 2.85	3.73 ± 0.01 3.57–4.14 3.33	3.94 ± 0.02 3.57–4.14 3.28	3.66 ± 0.01 3.29–4.14 4.41	3.96 ± 0.01 3.57–4.43 3.24	3.74 ± 0.02 3.57–4.00 2.78	3.78 ± 0.01 3.43–4.00 3.73
Greatest condylar depth	2.12 ± 0.01 1.86–2.43 5.35	2.03 ± 0.02 1.86–2.14 4.46	2.04 ± 0.01 1.86–2.29 4.85	2.14 ± 0.01 2.00–2.29 3.17	1.95 ± 0.01 1.71–2.29 4.69	2.11 ± 0.01 1.86–2.29 4.57	2.07 ± 0.02 2.00–2.29 4.31	2.00 ± 0.01 1.86–2.14 4.39
Width of lower condylar facet	1.24 ± 0.01 1.00–1.43 7.09	1.20 ± 0.01 1.14–1.29 5.98	1.20 ± 0.01 1.00–1.43 6.77	1.29 ± 0.01 1.14–1.43 3.96	1.18 ± 0.01 1.00–1.43 6.73	1.26 ± 0.01 1.14–1.43 6.56	1.18 ± 0.02 1.14–1.43 7.09	1.18 ± 0.01 1.00–1.29 6.36
Coronoid process-condylar length	2.88 ± 0.01 2.43–3.29 5.27	2.68 ± 0.02 2.43–2.86 4.15	2.69 ± 0.01 2.43–3.00 4.59	2.82 ± 0.01 2.57–3.00 3.87	2.62 ± 0.01 2.43–3.00 4.47	2.82 ± 0.01 2.57–3.14 3.91	2.71 ± 0.03 2.57–3.00 4.92	2.69 ± 0.01 2.29–3.00 4.07

Table 1. Continued.

Character	*S. m. obscurus* (n = 1677)	*S. m. parvidens* (n = 6)	*S. m. prevostensis* (n = 25)	*S. m. setosus* (n = 506)	*S. m. shumaginensis* (n = 194)	*S. m. soperi* (n = 1)	*S. m. neomexicanus* (n = 46)	*Sorex bairdi* (n = 110)
Maxillary breadth	4.88 ± 0.01 4.14–5.71 3.73	4.83 ± 0.08 4.57–5.14 4.35	5.21 ± 0.05 4.71–5.86 4.48	4.90 ± 0.01 4.43–5.43 3.96	4.82 ± 0.01 4.43–5.29 3.02	4.71	5.24 ± 0.02 5.00–5.57 3.29	5.49 ± 0.03 4.71–6.00 5.47
Least interorbital breadth	3.56 ± 0.01 3.00–4.14 3.77	3.43 ± 0.04 3.29–3.57 2.63	3.85 ± 0.02 3.57–4.00 2.38	3.58 ± 0.01 3.14–4.14 4.04	3.52 ± 0.01 3.29–3.86 3.28	3.43	3.80 ± 0.02 3.57–4.00 3.20	3.91 ± 0.02 3.43–4.43 4.90
Cranial breadth	8.37 ± 0.01 7.57–9.29 3.08	8.07 ± 0.15 7.71–8.71 4.44	8.78 ± 0.05 8.00–9.14 2.82	8.45 ± 0.01 7.43–9.43 3.73	8.56 ± 0.02 8.14–9.14 2.50	8.00	8.81 ± 0.04 8.14–9.29 3.50	9.26 ± 0.04 8.29–9.86 4.59
Breadth of zygomatic plate	2.03 ± 0.01 1.71–2.29 5.24	1.93 ± 0.03 1.86–2.00 4.06	1.97 ± 0.02 1.71–2.14 5.53	1.90 ± 0.01 1.57–2.14 5.67	1.98 ± 0.01 1.71–2.14 4.89	2.00	2.15 ± 0.01 2.00–2.43 4.19	2.11 ± 0.01 1.86–2.43 6.01
Breadth at M2-M2	4.48 ± 0.01 4.00–5.00 3.93	4.52 ± 0.07 4.29–4.71 3.82	4.62 ± 0.02 4.43–4.86 2.66	4.46 ± 0.01 3.86–5.14 3.96	4.35 ± 0.01 4.00–4.86 2.90	4.14	4.89 ± 0.03 4.57–5.14 3.59	4.97 ± 0.02 4.43–5.43 4.85
Breadth at U1-U1	1.79 ± 0.01 1.43–2.14 5.37	1.76 ± 0.03 1.71–1.86 4.19	1.79 ± 0.01 1.71–1.86 4.03	1.76 ± 0.01 1.57–2.00 5.89	1.74 ± 0.01 1.57–1.86 3.98	1.71	2.15 ± 0.01 2.00–2.29 3.81	2.07 ± 0.01 1.86–2.29 6.46
Breadth at U4-U4	2.26 ± 0.01 1.86–2.71 4.64	2.24 ± 0.03 2.14–2.29 3.30	2.35 ± 0.01 2.29–2.43 3.09	2.28 ± 0.01 2.00–2.57 5.31	2.18 ± 0.01 2.00–2.43 3.69	2.14	2.60 ± 0.02 2.43–2.71 4.23	2.70 ± 0.01 2.43–3.00 5.79
Width across I1-I1	1.49 ± 0.01 1.29–1.71 6.27	1.59 ± 0.02 1.57–1.71 3.66	1.55 ± 0.02 1.43–1.71 5.51	1.50 ± 0.01 1.29–1.71 7.36	1.49 ± 0.01 1.29–1.71 5.23	1.57	1.74 ± 0.01 1.57–1.86 5.15	1.79 ± 0.01 1.57–2.00 6.56

Length of P4-M3	4.04 ± 0.01 3.57–4.71 3.44	3.93 ± 0.07 3.71–4.14 4.45	4.29 ± 0.02 4.14–4.57 2.45	4.03 ± 0.01 3.57–4.57 3.34	3.97 ± 0.01 3.71–4.29 3.10	4.00	4.30 ± 0.02 4.00–4.57 3.46	4.39 ± 0.03 2.86–4.71 6.17
Length of unicuspid toothrow	2.38 ± 0.01 2.00–2.86 4.91	2.12 ± 0.07 1.86–2.29 7.88	2.51 ± 0.02 2.29–2.71 4.34	2.45 ± 0.01 2.14–2.86 5.29	2.49 ± 0.01 2.29–2.71 4.04	2.43	2.85 ± 0.03 2.57–3.29 6.55	2.80 ± 0.01 2.43–3.29 5.56
Cranial depth	4.90 ± 0.01 3.89–5.82 5.17	4.40 ± 0.04 4.31–4.52 2.00	5.23 ± 0.06 4.80–5.79 5.33	4.99 ± 0.01 4.19–5.71 5.88	5.13 ± 0.02 4.22–5.67 4.93	4.94	5.12 ± 0.04 4.45–5.67 5.33	5.27 ± 0.02 4.72–5.86 4.30
Greatest length of skull	17.00 ± 00.01 15.27–18.68 2.46	16.67 ± 00.15 16.21–17.11 2.17	18.34 ± 00.07 17.77–19.15 1.85	17.43 ± 00.02 15.76–18.65 2.41	17.20 ± 00.02 16.31–18.18 2.07	17.22	17.97 ± 00.03 17.42–18.65 1.31	18.66 ± 00.04 17.49–19.58 2.52
Length of mandible	7.79 ± 0.01 6.71–8.86 3.61	7.86 ± 0.10 7.57–8.14 3.04	8.41 ± 0.06 8.00–9.14 3.39	7.95 ± 0.01 6.71–9.14 4.21	7.79 ± 0.02 7.29–8.86 2.90	7.71	8.52 ± 0.05 7.71–9.14 3.92	9.03 ± 0.05 7.86–9.86 5.98
Length of mandibular toothrow	4.88 ± 0.01 4.14–5.43 3.42	4.83 ± 0.07 4.57–5.00 3.46	5.20 ± 0.02 5.00–5.43 2.38	4.91 ± 0.01 4.29–5.43 3.41	4.85 ± 0.01 4.57–5.29 2.63	4.86	5.46 ± 0.03 5.14–5.86 3.75	5.37 ± 0.03 4.71–5.86 5.06
Height of coronoid process	3.92 ± 0.01 3.29–4.43 4.34	3.81 ± 0.09 3.43–4.00 5.65	3.91 ± 0.03 3.57–4.14 3.49	3.84 ± 0.01 3.29–4.29 5.37	3.77 ± 0.01 3.57–4.14 3.17	3.71	4.47 ± 0.03 4.14–4.86 4.18	4.70 ± 0.03 4.00–5.29 7.06
Greatest condylar depth	2.03 ± 0.01 1.71–2.43 5.07	2.00 ± 0.04 1.86–2.14 4.52	2.18 ± 0.02 2.00–2.57 5.83	2.05 ± 0.01 1.71–2.43 5.57	2.04 ± 0.01 1.86–2.29 4.15	1.86	2.21 ± 0.01 2.00–2.43 4.46	2.33 ± 0.01 2.00–2.71 6.67
Width of lower condylar facet	1.22 ± 0.01 1.00–1.43 6.51	1.17 ± 0.02 1.14–1.29 5.00	1.30 ± 0.01 1.14–1.43 5.43	1.20 ± 0.01 1.00–1.43 7.04	1.17 ± 0.01 1.00–1.29 5.25	1.14	1.32 ± 0.01 1.14–1.43 5.31	1.42 ± 0.01 1.14–1.71 8.15
Coronoid process-condylar length	2.80 ± 0.01 2.29–3.29 5.02	2.81 ± 0.08 2.57–3.14 6.95	2.85 ± 0.02 2.57–3.00 3.68	2.78 ± 0.01 2.43–3.14 5.54	2.70 ± 0.01 2.43–3.00 4.41	2.71	3.10 ± 0.02 2.86–3.43 4.65	3.26 ± 0.02 2.71 –3.71 7.61

being a zone of intergradation, Tats Lake should be included within the range of *S. m. obscurus*. One individual each from Chilkoot Lake and Wells, and two from Skagway also were misclassified as *S. m. obscurus* (classification probabilities of 91%, 99%, 68%, and 95%, respectively). The area including all three of these localities also is near the zone of intergradation for *S. m. alascensis* and *S. m. obscurus*; dusky shrews from these localities should be considered *S. m. obscurus*. These 15 individuals were considered *S. m. obscurus* for further analyses.

In the discriminant analysis of *Sorex monticolus longicaudus* and *S. m. obscurus*, the individual from Eutsuk Lake and one of two from Meziadin Lake, British Columbia, were misclassified as *S. m. obscurus*. These lakes are on the eastern edge of the previously recognized distribution of *S. m. longicaudus*. The same two shrews from Meziadin Lake were misclassified in the discriminate analysis between *S. m. setosus* and *S. m. longicaudus* and had poor classification probabilities (≤ 60%) in the *S. m. alascensis* and *S. m. longicaudus* discriminant analysis. This indicated that these shrews do not belong with the *S. m. longicaudus* group and should be considered *S. m. obscurus*. All three individuals were added to the *S. m. obscurus* group for further analyses. In the same discriminant analysis both individuals from Lakelse Lake, British Columbia, were misclassified as *S. m. longicaudus* (having classification probabilities of 96% and 100%). This lake is near the point of parapatry for *S. m. obscurus* and *S. m. longicaudus;* Lakelse Lake should be included in the range of *S. m. longicaudus* resulting in an eastern shift in the distribution of *S. m. longicaudus*. Both of these individuals were grouped with *S. m. longicaudus* for further analyses.

In the discriminant analysis of *Sorex monticolus longicaudus* and *S. m. setosus*, 12 of 21 individuals from Goose Island, British Columbia, were misclassified as *S. m. setosus*. Ten of these 12 misclassifications had probability classifications ≥ 71%, whereas five of the nine "correct" classifications were < 70%. The mainland range of *S. m. setosus* extends from approximately Rivers Inlet, northeast to Hagensborg and Stuie, British Columbia. Goose Island is northwest of the previously accepted distribution of *S. m. setosus*; however, my results indicate that the shrews from Goose Island should be considered *S. m. setosus*. Similarly, the individual from Hecate Island, slightly northwest of Rivers Inlet, was misclassified as *S. m. setosus*. The classification probability was weak (63%), but this specimen was misclassified in three of five other discriminant analyses involving *S. m. longicaudus*. The degree of isolation could explain the poor classification probabilities of shrews from both Hecate Island and Goose Island. All 22 shrews were grouped with *S. m. setosus* for further analyses.

A series of three-group discriminant analyses was used in an attempt to clarify the relationships of the shrews from the coastal islands of British Columbia and Alaska. The Estevan group of islands, particularly Dewdney Island, British Columbia, is within the a priori group of *Sorex monticolus longicaudus;* however, it is isolated (ca. 10 km) from all other islands. In a discriminant analysis including *S. m. alascensis, S. m. longicaudus*, and *S. m. elassodon*, four of six shrews from Dewdney Island had classification probabilities ≥ 70% as *S. m. elassodon;* two had weak classification probabilities (50% and 51% as *S. m. longicaudus*). Similarly, in a discriminant analysis including *S. m. longicaudus, S. m. elassodon*, and *S. m. malitiosus*, the same shrews again were classified primarily as *S. m. elassodon;* four of six had classification probabilities ≥ 80% as *S. m. elassodon*, and two had weak classification probabilities (56% as *S. m. elassodon* and 51% as *S. m. longicaudus*). In spite of the geographic distance between Dewdney Island and the nearest population of *S. m. elassodon*, these shrews are allied more closely with *S. m. elassodon* than with *S. m. longicaudus*. Similarly, shrews from Porcher Island, British Columbia, ($n = 4$) previously were considered to be *S. m. longicaudus;* however, in the discriminant analysis including *S. m. alascensis, S. m. longicaudus*, and *S. m. elassodon* three of four individuals had classification probabilities ≥ 80% as *S. m. elassodon*. The classification probability of the fourth individual was weak (47%) but again was classified as *S. m. elassodon*. In a discriminant analysis including *S. m. longicaudus, S. m. elassodon*, and *S. m. malitiosus* all four shrews from Porcher Island had classification probabilities

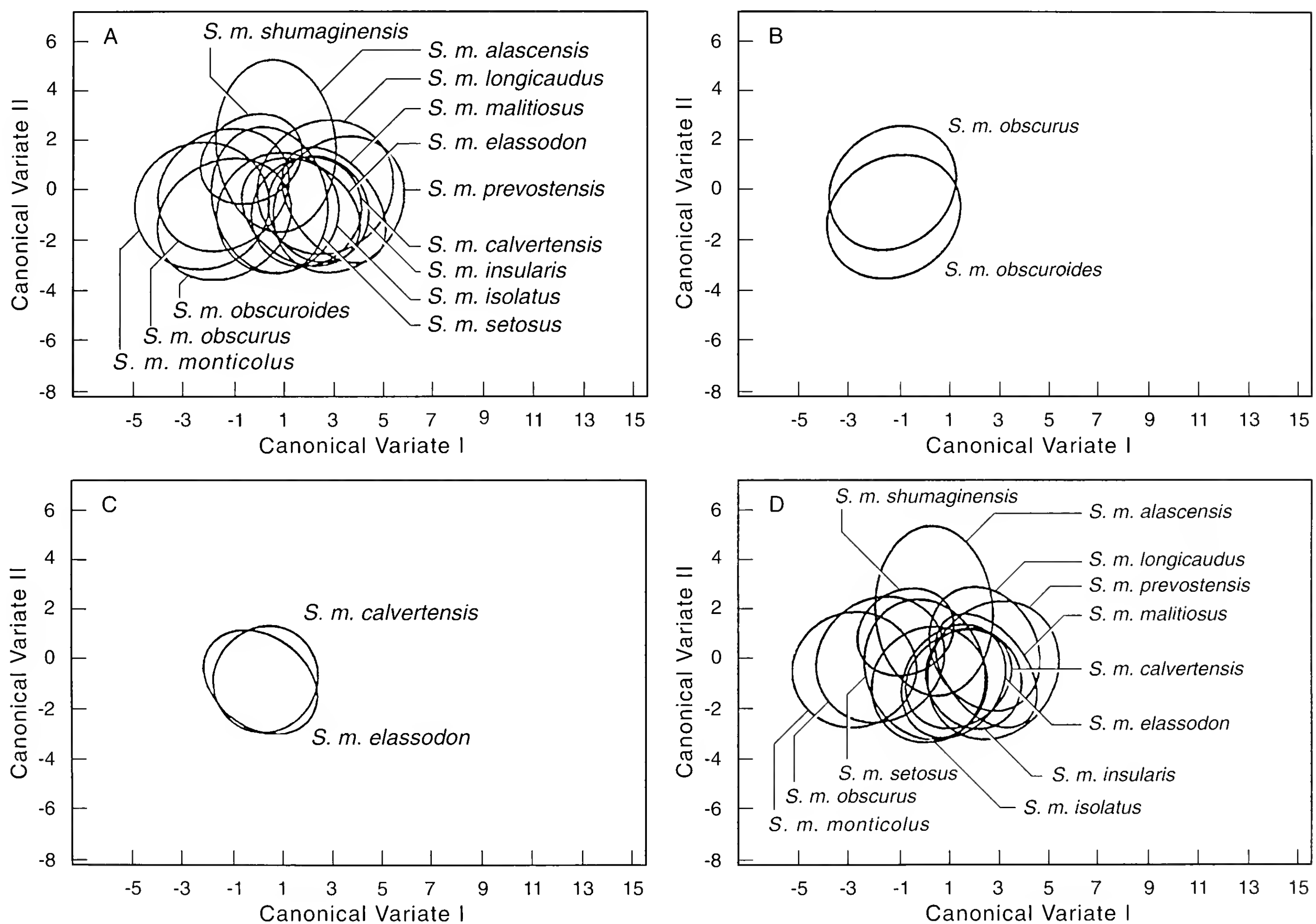


Fig. 7. Confidence ellipses (95%) for (**A**) the remaining 13 a priori *Sorex monticolus* groups, (**B**) *S. m. obscurus* and *S. m. obscuroides*, (**C**) *S. m. calvertensis* and *S. m. elassodon*, and (**D**) the 12 remaining groups after all specimens had been placed in appropriate groups.

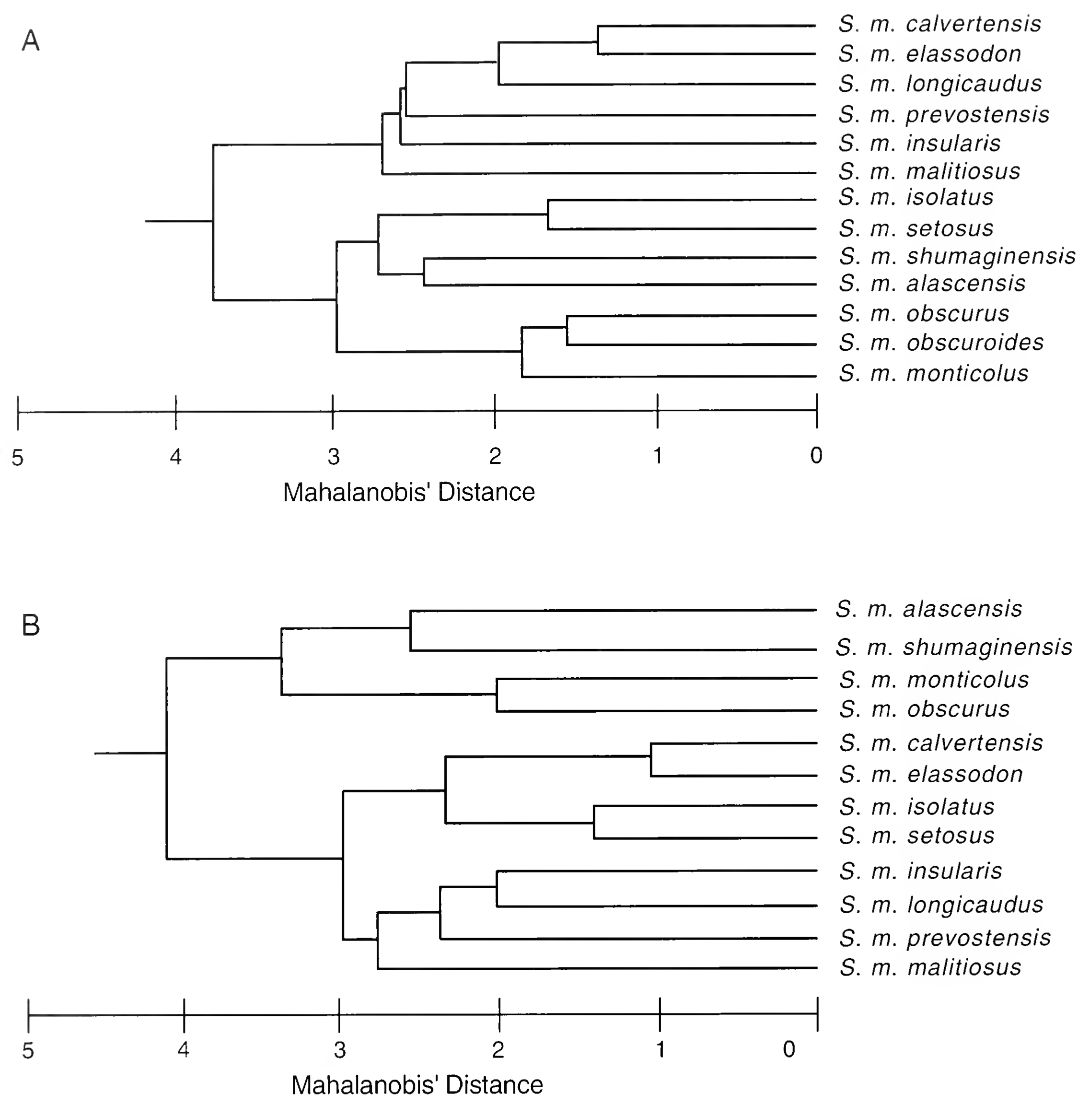


Fig. 8. Dendograms generated by cluster analyses based on the generalized-distance matrices derived from the multigroup discriminant analyses for (**A**) the 13 a priori groups, and (**B**) the 12 remaining groups with all specimens in groups.

≥ 81% as *S. m. elassodon*. In a discriminant analysis including *S. m. longicaudus*, *S. m. insularis*, and *S. m. calvertensis*, neither the shrews from Porcher Island nor from Dewdney Island were at all similar to *S. m. insularis* or *S. m. calvertensis*. These 10 shrews were grouped with *S. m. elassodon* for further analyses.

Admiralty Island, Alaska, previously was considered to be within the range of *Sorex monticolus elassodon*, but is near the zone of intergradation with *S. m. alascensis*. In the discriminant analysis including *S. m. alascensis*, *S. m. longicaudus*, and *S. m. elassodon* the individual from Admiralty Island had a strong classification probability (97%) as *S. m. alascensis*. In the discriminant analysis including *S. m. longicaudus*, *S. m. elassodon*, and *S. m. malitiosus* (but not including *S. m. alascensis*) this individual was classified as *S. m. longicaudus*.

Table 2. Results of two-group discriminant analyses for adjacent subspecies of *Sorex monticolus* used to diagnose specimens from localities between a priori polygons. All pairs of group centroids were significantly different ($P < 0.05$).

Subspecies 1	Subspecies 2	Correctly classified (%)	*F*-ratio	Wilks-Lambda	*df*	No. diagnosed as: Ssp. 1	Ssp. 2	Characters Subspecies 1 significantly different from Subspecies 2[a,b]: Smaller	Larger
S. m. shumaginensis	*S. m. obscurus*	94	60.097	0.6025525	18, 1640	6	4	MXBR, LIOB, ZYGP, M2M2, U1U1, U4U4, MNTR, CORH, WLCP, CCLG	
S. m. shumaginensis	*S. m. alascensis*	89	34.460	0.4065890	18, 425	7	2	All except CRDP	
S. m. obscurus	*S. m. alascensis*	94	92.756	0.5077228	18, 1722	—	5	All characters	
S. m. longicaudus	*S. m. alascensis*	90	53.613	0.3426359	18, 503	1	1	CRBR, ZYGP, M2M2, U1U1, LUPR, LGMN, CORH, CCLG	LIOB, U4U4, P4M3, GLSKL, WLCF
S. m. obscurus	*S. m. longicaudus*	98	179.998	0.3465134	18, 1718	1	1	All characters	
S. m. setosus	*S. m. longicaudus*	92	67.887	0.3618874	18, 693	17	25	All except CCLG	
S. m. isolatus	*S. m. setosus*	83	15.410	0.6776025	18, 583	3	8	All characters	
S. m. obscurus	*S. m. setosus*	88	90.915	0.5388240	18, 1912	8	6	LIOB, CRBR, U4U4, LUTR, CRDP, GLSKL, LGMN, LMTR, GCDP	ZYGP, M2M2, U1U1, P4M3, CORH, WLCF, CCLG
S. m. monticolus	*S. m. obscurus*	92	26.069	0.7749705	18, 1616	—	11	All except I1I1	

[a]Based on univariate Student-Newman-Keuls multiple-range tests.
[b]Acronyms for characters are defined in the legend to Fig. 4.

In the original 13-group discriminant analysis this individual had classification probabilities of 0% as *S. m. elassodon* and 10% as *S. m. alascensis*. These results taken together indicated that this individual does not have close affinities with *S. m. elassodon* and should be considered *S. m. alascensis*. This shrew was grouped with *S. m. alascensis* for further analyses.

Forrester Island is nearest to the distribution of *Sorex monticolus elassodon;* however, in the discriminant analysis including *S. m. alascensis, S. m. longicaudus*, and *S. m. elassodon* and in the discriminant analysis including *S. m. longicaudus, S. m. elassodon*, and *S. m. malitiosus*, the one individual from Forrester Island had a weak classification probability as *S. m. longicaudus* in both analyses (78% and 74%, respectively). Because the classification probabilities were relatively poor and because only one individual was examined from Forrester Island, this shrew was retained in the *S. m. elassodon* group. Shrews from the coastal islands of southeast Alaska and British Columbia, including Forrester Island, need further analysis to clarify these relationships.

Campania Island is within the range of *Sorex monticolus longicaudus*. In the discriminant analysis including *S. m. alascensis, S. m. longicaudus*, and *S. m. elassodon*, the shrews from Campania Island ($n = 2$) had weak classification probabilities as *S. m. elassodon* (65% and 75%). In the discriminant analysis including *S. m. longicaudus, S. m. elassodon*, and *S. m. malitiosus*, these shrews again were classified as *S. m. elassodon* (classification probabilities of 69% and 88%). In the discriminant analysis including *S. m. longicaudus, S. m. insularis*, and *S. m. calvertensis*, these shrews were classified as *S. m. longicaudus* (both had classification probabilities of 65%). Because classifications were poor and because only two individuals were examined from Campania Island, these shrews were retained in the *S. m. longicaudus* group. Shrews in the area including Campania Island also need further analysis to decipher their relationships.

A discriminant analysis for the remaining 12 groups (reflecting all group affiliation changes and the placement of diagnosed individuals) resulted in a 72% correct classification of individuals into their a priori groups. This reflects a slight improvement in the classification probabilities from the original a priori group affiliations. The first two canonical-variate axes represent 76.35% of the among-group variation (62.44% and 13.91%, respectively; Fig. 7D). The character with the highest positive coefficient of correlation to the first canonical-variate axis was greatest length of skull (0.768); all of the remaining characters had correlation coefficients < 0.400. Characters with the highest positive coefficients of correlation to the second canonical-variate axis were length of unicuspid toothrow (0.704), cranial breadth (0.604), breadth of zygomatic plate (0.584), length of mandibular toothrow (0.554), and height of coronoid process (0.513).

A cluster analysis of the generalized-distance matrix derived from character means resulted in a distance phenogram (Fig. 8B) that demonstrates the separation of the 12 groups into two large clusters at Mahalanobis' distance of 3.935. Changes made in the group affiliations did not alter the strong morphometric similarity of *Sorex monticolus calvertensis* and *S. m. elassodon;* these two taxa clustered together at a Mahalanobis' distance of 1.227. *Sorex m. isolatus* and *S. m. setosus* clustered together at Mahalanobis' distance of 1.529. However, the two-group discriminant analysis for *S. m. isolatus* and *S. m. setosus* indicated that these two taxa were significantly different. In the first discriminant analysis (including all 13 a priori groups before evaluation of group affiliation and addition of diagnosed individuals) the Mahalanobis' distance between *S. m. obscurus* and *S. m. monticolus* was 1.789 (Fig. 8A). After changing the group affiliation of the shrews from Mexico, western New Mexico, and northeastern Arizona from *S. m. monticolus* to *S. m. obscurus*, these two taxa were linked together at Mahalanobis' distance of 2.082 (Fig. 8B).

The primary difference between the results of the discriminant analyses including 12 and 13 subspecies is in the placement of *Sorex monticolus longicaudus*. In the original analysis (including 13 a priori groups), *S. m. longicaudus* grouped closely with *S. m. calvertensis* and *S. m. elassodon* (Fig. 8A). After the shrews from Goose and Hecate islands and Eutsuk and Meziadin lakes were removed from the *S. m. longicaudus* group, this taxon no longer clustered closely with *S. m. elassodon* or with *S. m. calvertensis* (Fig. 8B).

SYSTEMATICS AND TAXONOMY

ORDER INSECTIVORA
SUPERFAMILY SORICOIDEA
FAMILY SORICIDAE
SUBFAMILY SORICINAE
TRIBE SORICINI
Genus *Sorex*
Subgenus *Otisorex*

Sorex neomexicanus Bailey
New Mexico Shrew

1913. *Sorex obscurus neomexicanus* Bailey, Proc. Biol. Soc. Washington. 26:133, May.
1955. *Sorex vagrans neomexicanus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:50, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *neomexicanus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 100440, original number 7383; adult male collected 29 May 1900 from "Cloudcroft, New Mexico ... in the Sacramento Mountains" by V. Bailey.

Distribution.—*Sorex neomexicanus* occurs in south central New Mexico in the Capitan and Sacramento mountains. The distribution of this shrew might extend east at least as far as the Pecos River (Fig. 9).

Diagnosis.—*Sorex neomexicanus* can be distinguished from congeners in New Mexico by the following characters: from *S. nanus, S. cinereus,* and *S. merriami* by 3rd upper unicuspid smaller than 4th; from *S. palustris* by upper unicuspids wider than long, and possessing a brownish pelage instead of black and white; and from *S. monticolus obscurus* by a combination of a longer unicuspid toothrow and broader U1-U1.

Description.—*Sorex neomexicanus* is larger overall than any other *Sorex* in New Mexico except *S. palustris. S. neomexicanus* is considerably larger (Table 1) and slightly darker than *S. m. obscurus*; the dorsum is "dull sepia brown" with less reddish coloration than *S. m. obscurus*, and the venter has a "brownish suffusion" instead of the gray venter of *S. m. obscurus* (Bailey, 1913:134). Means for measured skull and mandible characteristics (in mm; n = 46) are (Fig. 10): maxillary breadth = 5.24, least interorbital breadth = 3.80, cranial breadth = 8.81, breadth at zygomatic plate = 2.15, breadth at M2-M2 = 4.89, breadth at U1-U1 = 2.15, breadth at U4-U4 = 2.60, width across I1-I1 = 1.74, length of P4-M3 = 4.30, length of unicuspid toothrow = 2.85, cranial depth = 5.12, greatest length of skull = 17.97, length of mandible = 8.52, length of mandibular toothrow = 5.46, height of coronoid process = 4.47, greatest condylar depth = 2.21, width of lower condylar facet = 1.32, coronoid process-condylar length = 3.10. Mean measurements for skin characteristics are (in mm): total length = 111.58 (n = 24), tail length = 43.76 (n = 25), and hind foot length = 13.32 (n = 25).

Comparisons and remarks.—*Sorex monticolus obscurus* is the only subspecies of *S. monticolus* in New Mexico and, therefore, the only one with which *S. neomexicanus* might be confused. In a discriminant analysis between these two taxa (F-ratio = 80.901, Wilks l = 0.5392039; df = 18, 1,704), 99.88% of the individuals were classified into their a priori groups. Length of unicuspid toothrow, breadth at U1-U1, length of mandibular toothrow, height of coronoid process, and breadth at U4-U4 accounted for the greatest degree of segregation. It is possible, however, to classify 97.1% of individuals as either *S. neomexicanus* or *S. m. obscurus* based solely on a combination of length of unicuspid toothrow and breadth at U1-U1 (F-ratio = 491.236, Wilks l = 0.6364543; df = 2, 1,720):

Length of unicuspid toothrow (5.27408)
– breadth at U1-U1 (5.99613)
– 23.3964
= discriminant score

where, if score < –3.1 = *S. neomexicanus*, and if score > –2.1 = *S. m. obscurus*. If the score for an individual is between these two values, it is not possible to assign it to either taxon.

When *Sorex bairdi* (n = 110), *S. monticolus* (n = 3454), and *S. neomexicanus* (n = 46) are considered jointly, 99% of individuals were classified into their correct a priori group (Fig. 11). Height of coronoid process, breadth at U4-U4, breadth at U1-

U1, and length of mandible accounted for the greatest degree of segregation. A cluster analysis based on the generalized-distance matrix derived from the multigroup discriminant analysis resulted in the joining of *S. bairdi* and *S. neomexicanus* at Mahalanobis' distance 4.587 and the subsequent joining of *S. monticolus* at Mahalanobis' distance 5.163 (Fig. 12).

Sorex bairdi Merriam
Baird's Shrew
Sorex bairdi bairdi Merriam

1895. *Sorex bairdi* Merriam, N. Amer. Fauna, 10:77, December.
1918. *Sorex obscurus bairdi* Jackson, Proc. Biol. Soc. Washington, 31:127, November.
1955. *Sorex vagrans bairdi* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:35, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *bairdii* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.
Incorrect use of terminal "i" on *bairdi.*
1990. *Sorex bairdii bairdii* Carraway, Spec. Publ., The Mus., Texas Tech Univ., 32:39.
Incorrect use of terminal "i" on *bairdi.*

Holotype.—USNM 17414/24318, original number 270; adult female collected on 2 August 1889 from "Astoria, Oregon" by T. S. Palmer.

Sorex bairdi permiliensis Jackson

1918. *Sorex obscurus permiliensis* Jackson, Proc. Biol. Soc. Washington, 31:128, November.
1955. *Sorex vagrans permiliensis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:36, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *permiliensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.
1977. *S*[*orex*]. *m*[*onticolus*]. *permilliensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:14, July.
Incorrect subsequent spelling.
1990. *Sorex bairdii permiliensis* Carraway, Spec. Publ., The Mus., Texas Tech Univ., 32:40.
Incorrect use of terminal "i" on *bairdi.*

Holotype.—USNM 91048, original number 4756; adult male collected 2 October 1897 from "Permilia [= Pamelia] Lake, west base of Mount Jefferson, Cascade Range, Oregon" by J. A. Loring.

Distribution.—*Sorex bairdi bairdi* occurs along the Pacific Coast in northwestern Oregon, east into the Coast Range and along the Columbia River into Multnomah and Clackamas counties, and south as far as Benton County. *Sorex b. permiliensis* occurs in the Cascade Range of Oregon from the Columbia River south to southern Lane County.

Comparisons and remarks.—*Sorex monticolus setosus* is the nearest subspecies of *S. monticolus* geographically with which *S. bairdi* could be confused. *Sorex m. setosus* occurs primarily in western Washington and British Columbia but includes a narrow zone in northwestern Oregon where it presumably crossed the Columbia River during a landslide about 1,700 years ago (Carraway, 1990). In this region of Oregon, *S. m. setosus* and *S. bairdi* are sympatric.

Identification of specimens to either species requires use of a combination of characters, as follows:

1. Breadth at U4-U4 (1.78388) – greatest length of skull (0.70523) – height of coronoid process (2.55808) – 26.9517 = discriminant score.
   If score < 0.51 = *S. monticolus setosus;* if score > 1.15 = *S. bairdi.*
2. Maxillary breadth (0.60984) – cranial breadth (–1.60895) – breadth at M2-M2 (–0.32228) – breadth at U1-U1 (–1.76036) – breadth at U4-U4 (3.07972) – width across I1-I1 (1.10145) – length of unicuspid toothrow (–0.30093) – greatest length of skull (0.70490) – length of mandible (0.70595) – length of mandibular toothrow (–0.06265) – height of coronoid process (3.31541) – coronoid process-condylar length (–0.54096) – 22.4232 = discriminant score.
   If score < 0.66 = *S. monticolus setosus;* if score > 1.23 = *S. bairdi.*

By use of the first formula, with three characters, 90.6% of specimens can be classified to species (Fig. 4C) and by use of the second formula, with 12 characters, 94.3% of specimens can be classified to species. In either instance, if the discriminant score of an individual is between the two values presented, it is not possible to assign it to either taxon.

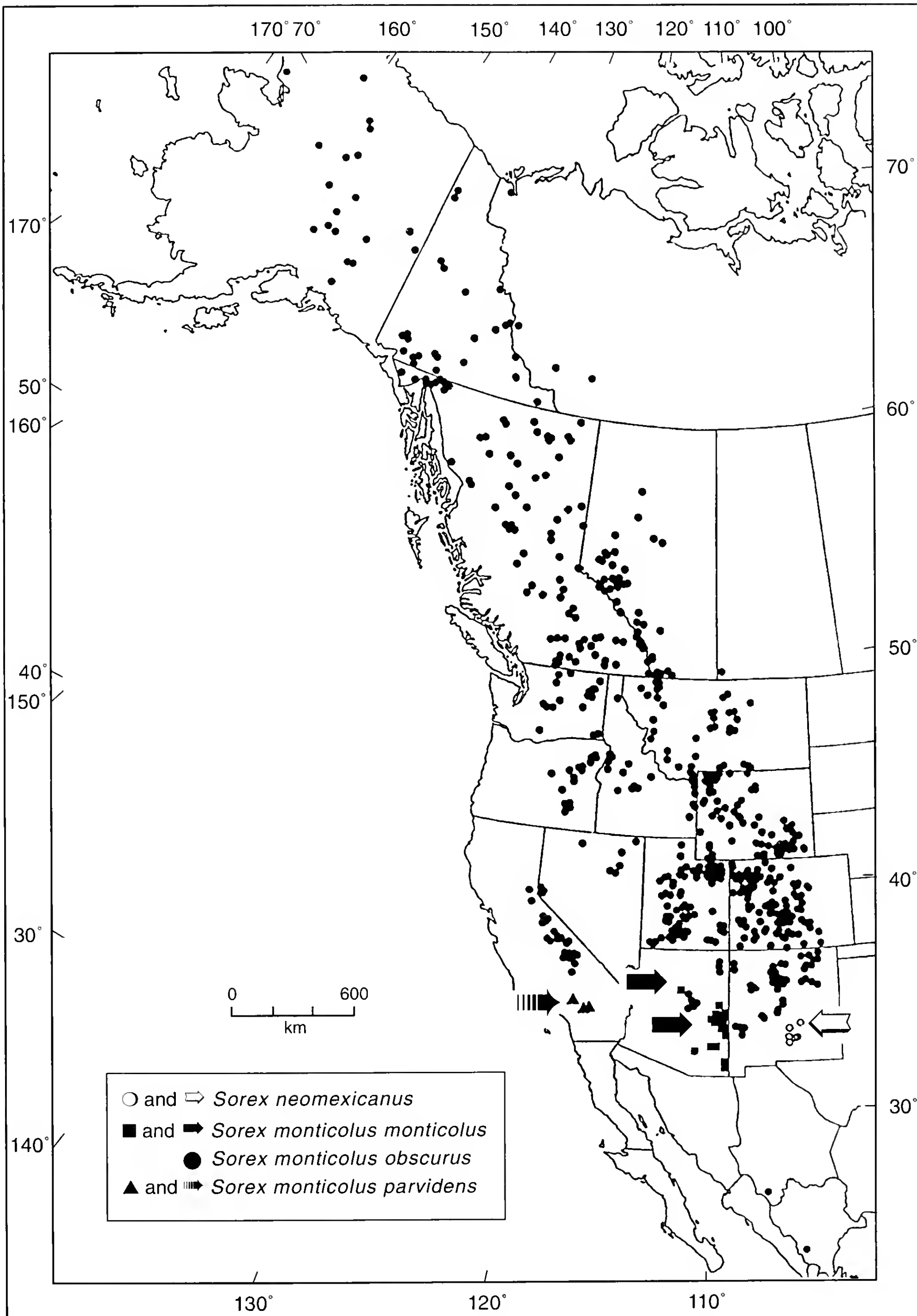


Fig. 9. Distribution of localities for specimens of *Sorex neomexicanus*, *S. monticolus monticolus*, *S. m. obscurus*, and *S. m. parvidens* included in this analysis representing 11, 39, 794, and 5 unique localities, respectively.

In the original description of *Sorex bairdi* (Merriam, 1895), only one terminal "i" was used. Hennings and Hoffmann (1977) were inconsistent in their spelling, using both one terminal "i" (Hennings and Hoffmann, 1977:4, 6, 14, 18, 26) and two terminal "i's" (Hennings and Hoffmann, 1977:10, 15, 19). Carraway (1990) employed two "i's" when she resurrected the species. Because only one terminal "i" was used in the original description, I am returning the name to its original and correct spelling (International Trust for Zoological Nomenclature, 1985:75, Article 33d). In an attempt to avoid perpetuating the spelling error, I have used *S. bairdi* throughout the text except when referring to a specific taxonomic treatment in which two "i's" were used.

Sorex monticolus Merriam
Dusky Shrew

1890. *Sorex monticolus* Merriam, N. Amer. Fauna, 3:43, September.
1895. *Sorex vagrans monticola* Merriam, N. Amer. Fauna, 10:69, December.
1895. *Sorex obscurus* Merriam, N. Amer. Fauna, 10:72, December.
1977. *Sorex monticolus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:2, July.

Sorex monticolus alascensis Merriam

1895. *Sorex obscurus alascensis* Merriam, N. Amer. Fauna, 10:76.
1900. *Sorex glacialis* Merriam, Proc. Washington Acad. Sci., 2:16, March.
1900. *S[orex]. alascensis* Merriam, Proc. Washington Acad. Sci., 2:18, March.
1901. *Sorex glacialis alascensis* Elliot, Field Columb. Mus., Publ. 45, Zool. Ser., 2:372.
1902. *Sorex obscurus alascensis* Allen, Bull. Amer. Mus. Nat. Hist., 16:229.
1955. *Sorex vagrans alascensis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:41, December.
1977. *S[orex]. m[onticolus]. alascensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 73539; young adult male collected 10 July 1895 from "Yakutat Bay, Alaska" by C. P. Streator.

Distribution.—*Sorex monticolus alascensis* occurs in a narrow band in southeastern Alaska from western Prince William Sound, southeast along the Pacific Coast through Glacier Bay to approximately Juneau and Admiralty Island. The southwestern edge of the northwestern triangle of British Columbia is included in the range of *S. m.* alascensis (Fig. 13).

Subspecific comparisons and remarks.—*Sorex monticolus alascensis* and *S. m. elassodon* are adjacent taxa south of Admiralty Island, along Frederick Sound, and probably south of Glacier Bay along Cross Sound, Icy Strait, and Chatham Strait. Hall (1981) did not include Chichagof or Kruzof islands in the distributions of these taxa. I found no shrews from either of these islands. *Sorex m. alascensis* averages significantly larger than *S. m. elassodon* in all characters included in this analysis except greatest length of skull; there was no significant difference between the means of this character (Table 2).

Sorex monticolus alascensis and *S. m. longicaudus* are adjacent taxa in a narrow band across southeast Alaska in the vicinity of Taku Inlet and Stephens Passage. The only apparent zone of intergradation between these two subspecies includes the region near Juneau and Holkham Bay. Stephens Passage separates these taxa along most of their adjacent distributions. *Sorex m. alascensis* averages smaller than *S. m. longicaudus* in some characters and larger in others (Table 2).

Sorex monticolus alascensis and *S. m. obscurus* are adjacent taxa in Alaska from just north of Prince William Sound southeast to northwestern British Columbia. The zone of intergradation between these two subspecies includes Valdez Narrows, Alaska, a region south of Tats Lake, British Columbia, and the area near Haines, British Columbia. Shrews from Tats Lake had strong affinities with *S. m. obscurus* and did not seem to exhibit significant intergradation. This results in a relatively narrow band of *S. m. alascensis* and probably some intergradation along the coastline near Yakutat Bay. *Sorex m. obscurus* averages significantly smaller than *S. m. alascensis* in all characters (Table 2).

Sorex monticolus alascensis and *S. m.*

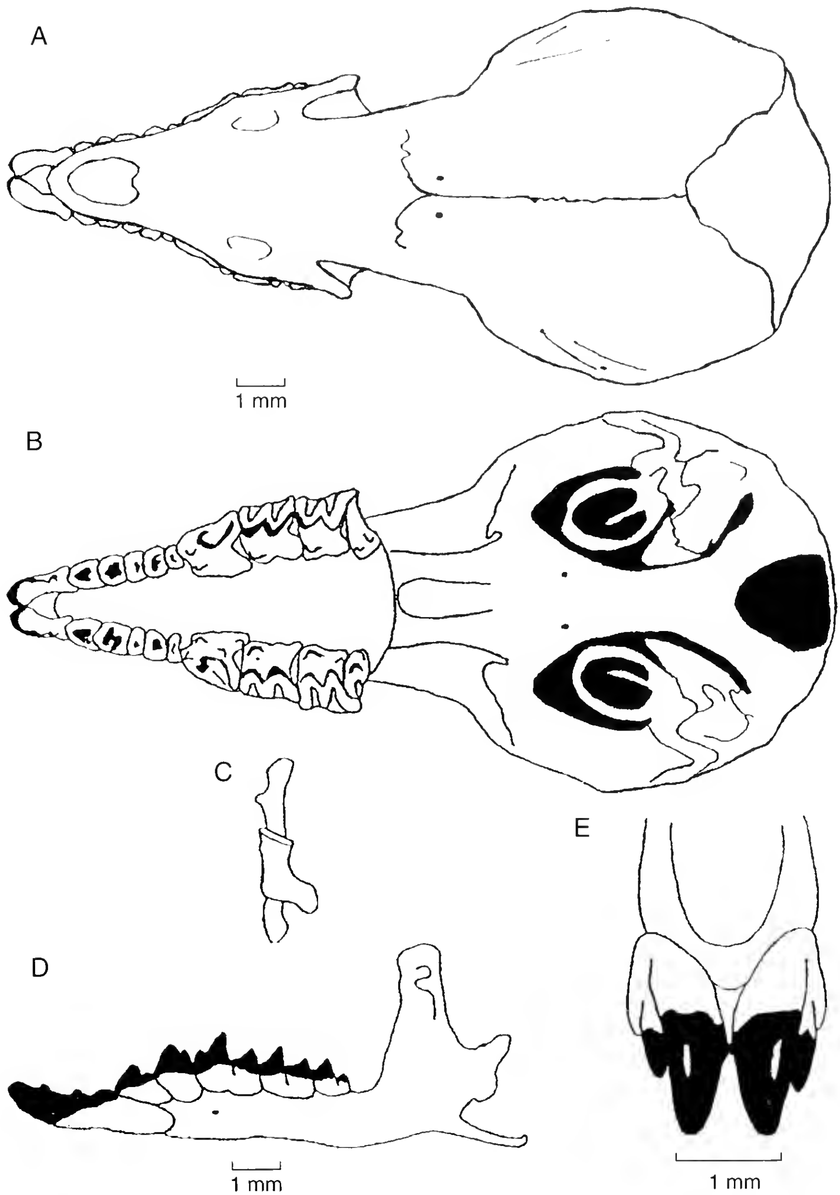


Fig. 10. Skull and mandible of *Sorex neomexicanus* (MSB 41081). Dorsal (**A**) and ventral (**B**) views of skull; posterior (**C**) and lateral (**D**) views of mandible, and anterior view of upper incisors (**E**).

shumaginensis are adjacent taxa north and west of Prince William Sound, Alaska. The zone of intergradation between these two subspecies includes Seward, Soldotna, Hope, Anchorage, Coghill Point, and Wasilla, Alaska. *Sorex m. shumaginensis* tends to be smaller than *S. m. alascensis* (Table 2).

Sorex monticolus calvertensis Cowan

1941. *Sorex obscurus calvertensis* Cowan, Proc. Biol. Soc. Wash., 54:103, July.

1955. *Sorex vagrans calvertensis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:39, December.

1977. *S[orex]. m[onticolus]. calvertensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—RBCM 1947; adult male collected 14 July 1937 from "Safety Cove, Calvert Island, British Columbia" by T. T. McCabe and E. B. McCabe.

Distribution.—*Sorex monticolus calvertensis* occurs on two widely separated islands, Banks Island and Calvert Island, off the coast of British Columbia (Fig. 14).

Subspecific comparisons and remarks.—This taxon is nearly identical morphometrically with *S. m. elassodon.* The large distance separating the two islands considered to be occupied by *S. m. calvertensis* suggests the possibility of more than one taxon being involved. Both the summer and winter pelages of these shrews, however, are much paler than that of *S. m. elassodon* or *S. m. longicaudus.* Because of the small sample size of *S. m. calvertensis* included in this analysis, a conservative interpretation was employed, and this taxon is recognized as a distinct subspecies although further research may indicate otherwise.

Ranges of *Sorex monticolus calvertensis* and *S. m. longicaudus* are adjacent along Principe Channel east of Banks Island, and along Fitzhugh Sound east of Calvert Island. The shrews from Banks and Calvert islands demonstrated weak affinities with *S. m. longicaudus.* Morphometrically, *S. m. calvertensis* is more similar to *S. m. elassodon* than to *S. m. longicaudus. Sorex m. calvertensis* averages smaller than *S. m. longicaudus* in all characters (Table 2).

Sorex monticolus elassodon Osgood

1901. *Sorex longicauda elassodon* Osgood, N. Amer. Fauna, 21:35, September.

1905. *Sorex obscurus elassodon* Elliot, Field Columb. Mus., Publ. 105, Zool. Ser., 6:450.

1955. *Sorex vagrans elassodon* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:40, December.

1977. *S[orex]. m[onticolus]. elassodon* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 100597, original number 1030; young adult male collected 13 June 1900 from "Cumshewa Inlet, Moresby Island, Queen Charlotte Islands, British Columbia" by W. H. Osgood and E. Heller.

Distribution.—*Sorex monticolus elassodon* occurs from Baranof, Kupreanof, and Mitkof islands, Alaska, southward through the Pacific coastal islands of Alaska primarily west of Stikine and Clarence straits (including Prince of Wales, Forrester, and San Fernando islands). The distribution extends south into British Columbia to include two isolated island groups, Porcher and Dewdney islands (from the Estevan group), as well as the Queen Charlotte Islands (excluding Kunghit Island) of British Columbia (Fig. 14).

Subspecific comparisons and remarks.—*Sorex monticolus elassodon* and *S. m. longicaudus* are adjacent taxa along the eastern reach of Frederick Sound, Stikine Strait, and along Clarence Strait, Alaska. Shrews from Dewdney and Porcher islands are referable to *S. m. elassodon.* These islands are adjacent to islands inhabited by *S. m. longicaudus* along the Pacific Coast of British Columbia. Campania Island is directly east of the Estevan group of islands (including Dewdney Island) and shrews there exhibited some affinities with both *S. m. longicaudus* and *S. m. elassodon.* Shrews on Prince of Wales Island, Alaska, also exhibited some affinities with *S. m. longicaudus*, but they remain referable to *S. m. elassodon. Sorex m. elassodon* averages significantly smaller than *S. m. longicaudus* in all characters (Table 2).

The ranges of *Sorex monticolus elassodon* and *S. m. malitiosus* are separated by Summer Strait, Sea Otter Sound, and Iphigenia Bay, Alaska. Coronation Island is relatively isolated from all other islands and shrews from there were classified strongly as *S. m. malitiosus.* Warren Island is much closer to the islands inhabited by *S. m. elassodon* and shrews from there exhibited some affinities with *S. m. elassodon*, but remain referable to *S. m. malitiosus. S. m. elassodon* averages significantly smaller than *S. m. malitiosus* in most characters (Table 2).

The ranges of *Sorex monticolus elassodon* and *S. m. prevostensis* are separated by the Houston Stewart Channel of the Queen Charlotte Islands, British Columbia. No intergradation between these two subspecies was indicated by the classifications of these shrews. Shrews in the *S. m. prevostensis* a priori group misclassified in the 12-group discrimi-

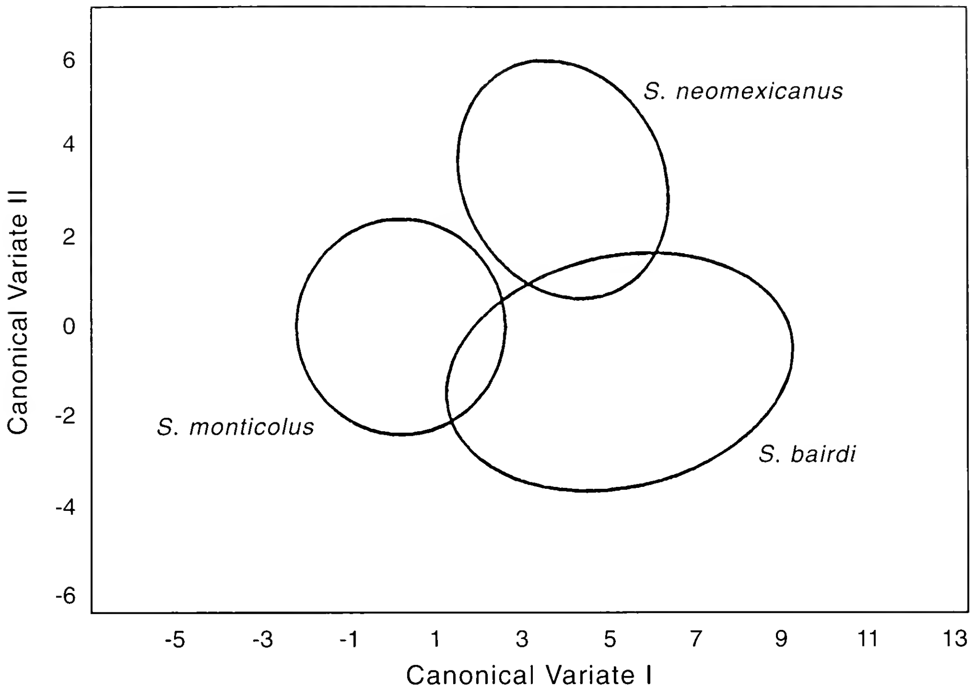


Fig. 11. Confidence ellipses (95%) for *Sorex bairdi, S. neomexicanus,* and *S. monticolus.*

nant analysis were more similar to *S. m. longicaudus* than to *S. m. elassodon. Sorex m. prevostensis* tends to be larger than *S. m. elassodon* in all characters (Table 2).

Sorex monticolus insularis Cowan

1941. *Sorex obscurus insularis* Cowan, Proc. Biol. Soc. Wash., 54:103, July.

1955. *Sorex vagrans insularis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:39, December.

1977. *S*[*orex*]. *m*[*onticolus*]. *insularis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—RBCM 3110; adult female collected 24 August 1938 from "Smythe Island, Bardswell group, British Columbia" by T. T. McCabe and E. B. McCabe.

Distribution.—*Sorex monticolus insularis* is restricted to the western portion of the Bardswell group of islands off the Pacific Coast of British Columbia including Reginald, Smythe [=Athlone], and Townsend Islands (Fig. 14).

Subspecific comparisons and remarks.—Ranges of *Sorex monticolus insularis* and *S. m. longicaudus* are separated by the Seaforth Channel to the north, Gale Passage to the east, and Waskesiu Passage to the south. Dufferin and Horsfall islands are part of the Bardswell group, but are separated from islands inhabited by *S. m. insularis* by Gale Passage; shrews from Dufferin and Horsfall islands have been considered *S. m. longicaudus.* In this analysis, 72.7% (n = 11) of the shrews from these islands had classification probabilities ≥ 77% as *S. m. longicaudus;* however, three individuals were classified as *S. m. insularis.* Gale Passage separates Smythe Island, the eastern-most island occupied by *S. m. insularis,* and Dufferin Island, but it is relatively narrow in some places and probably does not eliminate all gene flow. Some of the 19 shrews from Smythe Island included in this analysis were classified as *S. m. longicaudus,* some as *S. m. insularis,* and several had intermediate classifications. The latter individuals might be intermediates between *S. m. insularis* and *S. m. longicaudus. Sorex m. insularis* averages smaller than *S. m. longicaudus* in some characters and larger in others (Table 2).

Sorex monticolus isolatus Jackson

1922. *Sorex obscurus isolatus* Jackson, J. Washington Acad. Sci., 12:263, June.
1955. *Sorex vagrans isolatus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:38, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *isolatus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 177719, original number 517; adult male collected 21 May 1911 from the "Mouth of Millstone Creek, Nanaimo, Vancouver Island, British Columbia" by F. A. Wetmore.

Distribution.—*Sorex monticolus isolatus* occurs on Vancouver Island, British Columbia, Denman Island, on the eastern coast of Vancouver Island, and on many small islands along the western coast of Vancouver Island. Whidbey Island also may be inhabited by *S. m. isolatus* (Fig. 15).

Subspecific comparisons and remarks.—In an analysis of *Sorex monticolus* and *S. vagrans*, George and Smith (1991:87) indicated that the shrews from the San Juan Islands "approach *S. monticolus* in cranial size" in a univariate analysis and that "most of the Gulf and San Juan Island populations segregate from other *S. vagrans* centroids and ordinate toward the *S. monticolus* centroids" in a multivariate approach. Even though they were larger in some of their characters than either Vancouver Island or mainland samples of *S. vagrans*, George and Smith (1991) found that shrews from San Juan, Lopez, Pender, Saturna, and Samuel islands were more similar to *S. vagrans* than to *S. monticolus* and suggested that *S. monticolus* does not occur on these islands. The same authors also examined 10 shrews from Whidbey Island, Washington; they classified nine of these shrews as *S. vagrans* and one as *S. monticolus*. They concluded that more shrews from Whidbey Island needed to be examined before drawing conclusions regarding the presence of *S. monticolus* on Whidbey Island. In the discriminant analysis between *S. m. isolatus* and *S. m. setosus* the one individual from Whidbey Island had a strong classification probability (89%) of being *S. m. isolatus*. I referred this individual to *S. m. isolatus*. It was not possible to ascertain if this was the same specimen that George and Smith (1991) considered *S. monticolus*.

Ranges of *Sorex monticolus isolatus* and *S. m. setosus* are adjacent east and south of Vancouver Island, British Columbia. They are separated by the Queen Charlotte Strait, Johnstone Strait, Strait of Georgia, and the Strait of Juan de Fuca. Shrews from Sonora, Maurelle, Stuart, Cortes, Bowen, and Marina islands were classified strongly as *S. m. setosus* in this analysis. *Sorex m. isolatus* averages significantly smaller than *S. m. setosus* in all characters (Table 2).

Sorex monticolus longicaudus Merriam

1895. *Sorex obscurus longicauda* Merriam, N. Amer. Fauna, 10:74, December.
1900. *S*[*orex*]. *longicauda* Merriam, Proc. Washington Acad. Sci., 2:16, March.
1901. *Sorex obscurus longicaudus* Elliot, Field Columb. Mus., Publ. 45, Zool. Ser., 2:372.
1955. *Sorex vagrans longicauda* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:37, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *longicauda* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.
First use of name combination, incorrect gender.

Holotype.—USNM 74711, original number 4891; adult male collected 9 September 1895 from "Wrangel, southeast Alaska" by C. P. Streator.

Distribution.—*Sorex monticolus longicaudus* occurs along the Pacific Coast of southeast Alaska from Taku Inlet (south of Juneau) south along the coastline east of Stephens Passage, Frederick Sound, and Clarence Strait. In British Columbia, the distribution of *S. m. longicaudus* extends south along the coastline east of Chatham Sound, Principe Channel, and Estevan Sound, including Pitt, Campania, Princess Royal, Swindle, Dufferin, Horsfall, Campbell, and Spider islands, and the Hunter group of islands, but excludes Porcher Island, the Estevan group, the western portion of the Bardswell group, Goose Island, and Hecate Island. The distribution of *S. m. longicaudus* continues south to approximately Rivers Inlet. *Sorex m. longicaudus* extends east from Taku Inlet, Alaska, to approximately the Coast Mountains, east of the Alaska-British Columbia border; it continues south roughly following the border, west of Meziadin Lake, Smithers,

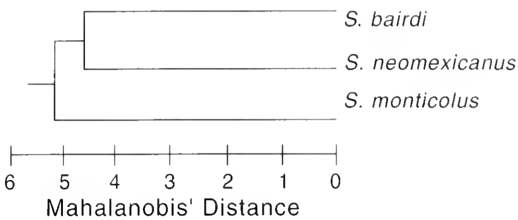


Fig. 12. A dendogram generated by a cluster analysis based on the generalized-distance matrix derived from the multigroup discriminant analysis for *Sorex bairdi*, *S. neomexicanus*, and *S. monticolus*.

and Eutsuk Lake to approximately Stuie, Hagensborg, and Bella Coola (Fig. 16).

Subspecific comparisons and remarks.—In Merriam's (1895) original description of the currently recognized subspecies *Sorex monticolus longicaudus* (Merriam, 1895) the name was spelled "*longicauda*." When Elliot (1901) returned it to subspecific status he corrected the spelling to "*longicaudus*" to agree in gender with the masculine *Sorex* and *obscurus*. The spelling returned to "*longicauda*" when Findley (1955) subsumed *obscurus* into *Sorex vagrans*. Hennings and Hoffmann (1977) separated *S. monticolus* and *Sorex vagrans* but retained the spelling *longicauda*. The correct spelling of this name is "*longicaudus*" to agree in gender with the masculine *Sorex* and *monticolus* (International Trust for Zoological Nomenclature, 1985:63, Article 31b). In an attempt to avoid perpetuating the spelling error, I have used *longicaudus* throughout the text except when referring to a specific taxonomic treatment in which the feminine form was used.

The ranges of *Sorex monticolus longicaudus* and *S. m. obscurus* are parapatric in southeastern Alaska and western British Columbia from about Taku Inlet, Alaska, southward along the Alaska-British Columbia border, just west of the Coast Mountains, and southward along the Hazelton Mountains of British Columbia. A zone of intergradation between these two subspecies includes the Stikine and Klappan River valleys, Meziadin, Lakelse, and Eutsuk lakes, and Kimsquit, British Columbia. *Sorex m. longicaudus* is larger than *S. m. obscurus* in most characters (Table 2).

Ranges of *Sorex monticolus longicaudus* and *S. m. setosus* are parapatric in southwestern British Columbia at Rivers Inlet and eastward to approximately Hagensborg and Stuie. All shrews from Rivers Inlet were classified into the taxon with which they were most similar by use of a diagnosis file generated in the discriminant analysis between *S. m. longicaudus* and *S. m. setosus*. Some shrews from Rivers Inlet were classified strongly, and some weakly, as one or the other of the two subspecies. This indicates that this region is part of a zone of intergradation between these two subspecies. Also included in this zone of intergradation are Bella Coola, Hagensborg, and Stuie. *Sorex m. longicaudus* averages larger than *S. m. setosus* in all characters (Table 2).

Sorex monticolus malitiosus Jackson

1919. *Sorex obscurus malitiosus* Jackson, Proc. Biol. Soc. Washington, 32:23, April.
1955. *Sorex vagrans malitiosus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:40, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *malitiosus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—MVZ 8401, original number 7532; adult female collected 21 May 1909 from "east side of Warren Island, Alaska" by H. S. Swarth.

Distribution.—*Sorex monticolus malitiosus* is restricted to Coronation and Warren islands in southeast Alaska (Fig. 16).

Subspecific comparisons and remarks.—The shrews from Coronation Island grouped strongly with *Sorex monticolus malitiosus* in the *longicaudus-elassodon-malitiosus* discriminant analysis employed in this study. The shrews from Warren Island had slightly weaker classifications and tended toward *S. m. longicaudus* (instead of *S. m. elassodon* as might be expected on the basis of its proximity), but are still referable to *S. m. malitiosus*.

Sorex monticolus monticolus Merriam

1890. *Sorex monticolus* Merriam, N. Amer. Fauna, 3:43, September.
1895. *Sorex vagrans monticola* Merriam, N. Amer. Fauna, 10:69, December.
1977. *S*[*orex*]. *m*[*onticolus*]. *monticolus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 17599/24535, original number 406; adult male collected 28 August 1889 from "San Francisco Mountain, Arizona" by C. H. Merriam and V. Bailey.

Distribution.—*Sorex monticolus monticolus* is restricted to southeastern Arizona and an isolated population in the San Francisco Mountains of north central Arizona (Fig. 9).

Subspecific comparisons and remarks.—*Sorex monticolus monticolus* and *S. m. obscurus* are separated in east central Arizona by the Mogollon Plateau. Their adjacent ranges extend southward approximately along the Arizona-New Mexico border. These two subspecies do not seem to intergrade along the Mogollon Plateau, but along the southeastern border of Arizona and New Mexico a zone of intergradation includes the region around Mogollon, New Mexico, and the Chiricahua Mountains in Cochise County, Arizona. *Sorex m. monticolus* averages smaller than *S. m. obscurus* in all characters (Table 2).

Sorex monticolus obscurus Merriam

1891. *Sorex vagrans similis* Merriam, N. Amer. Fauna, 5:34, July.
Name preoccupied by *Sorex similis* Hensel [*Neomys similis*].

1895. *Sorex obscurus* Merriam, N. Amer. Fauna, 10:72, December.

1955. *Sorex vagrans obscurus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:43, December.

1955. *Sorex vagrans obscuroides* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:58, December.

1977. *S*[*orex*]. *m*[*onticolus*]. *obscurus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 23525/30943, original number 1670; adult female, collected 26 August 1890 from "Timber Creek, Salmon River Mountains, Idaho" by B. H. Dutcher.

Distribution.—*Sorex monticolus obscurus* occurs from eastern Alaska, south through western Canada including the Yukon Territory, Northwest Territories, British Columbia, Alberta, and southwestern Saskatchewan, but excluding the western and southwestern coastline of British Columbia. The distribution of *S. m. obscurus* continues southward into eastern Washington and through the Rocky Mountains of the United States, including Idaho, Montana, Wyoming, Utah, Colorado, Arizona, and New Mexico, and south into Mexico. Several isolated groups of *S. m. obscurus* occur in mountainous offshoots of the Rockies including the Wallowa, Blue, and Steens mountains of Oregon, the Ruby, Santa Rosa, and Carson mountains of Nevada, and the Sierra Nevada mountains of California (Fig. 9).

Subspecific comparisons and remarks.—Ranges of *Sorex monticolus obscurus* and *S. m. setosus* are adjacent in southwestern British Columbia and central Washington. A zone of intergradation between these two subspecies in British Columbia includes Anahim Lake, Itcha Mountain, and Chezacut. The Fraser Plateau and the Cascade Range of British Columbia and Washington separates *S. m. setosus* and *S. m. obscurus* southward. A zone of intergradation in this region includes Hope and Manning Provincial Park in British Columbia, and Barron, Slate Peak, Stehekin, head of Lake Chelan, Cloudy Pass, Lyman Lake, Wenatchee Lake, Keechelus Lake, Easton, Lester, Corral Pass, Owyhigh Lake, Crystal Mountain, Council Pass, Signal Peak, and southward to approximately the White Salmon River in southern Washington. *Sorex m. obscurus* averages smaller than *S. m. setosus* in some characters and larger in others (Table 2).

Ranges of *Sorex monticolus obscurus* and *S. m. shumaginensis* are adjacent in central Alaska. The zone of intergradation includes Fishhook, head of Toklat River, Maclaren, Glenn Highway at Eureka, Denali National Park, Healy, Kakagrak, and the Noatak Valley in northwestern Alaska. Populations from these localities contained some shrews classified as *S. m. shumaginensis* and some as *S. m. obscurus*. In most cases, these classifications were weak; this suggests that these shrews are different only at the subspecific level and are not sympatric species. The univariate Student-Newman-Keuls multiple-range test indicated that *S. m. shumaginensis* is significantly smaller than *S. m. obscurus* in some characters but larger in others (Table 2).

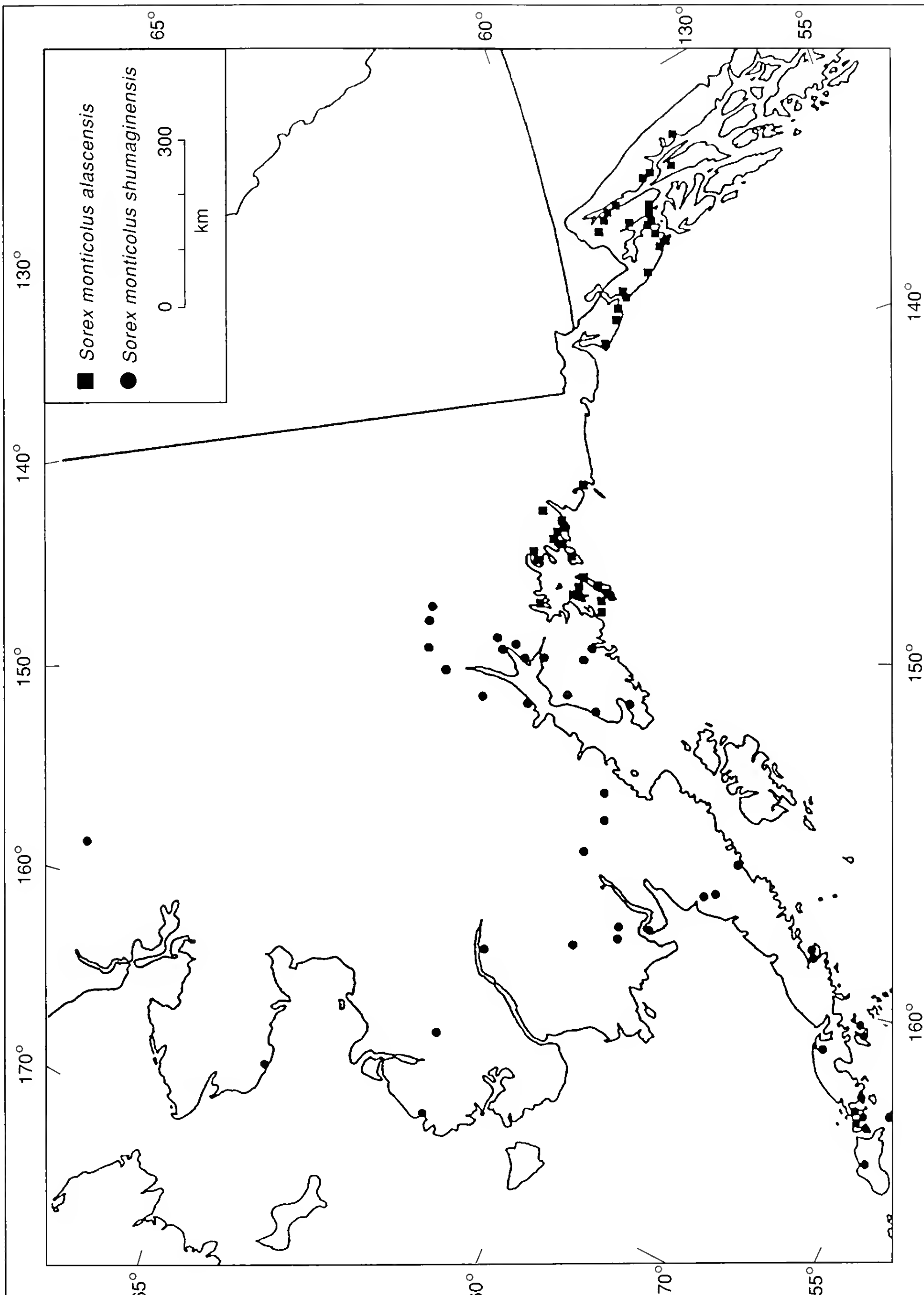


Fig. 13. Distribution of localities for *Sorex monticolus alascensis* and *S. m. shumaginensis* specimens included in this analysis representing 63 and 52 unique localities, respectively.

Sorex monticolus parvidens Jackson

1921. *Sorex obscurus parvidens* Jackson, J. Mammal., 2:161.
1955. *Sorex vagrans parvidens* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:58, December.
1977. *S[orex]. m[onticolus]. parvidens* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 56561, original number 242; adult male collected 3 October 1893 from "Thurman's Camp, Bluff Lake, … western side of San Bernardino Peak, San Bernardino Mountains, California" by J. E. McLellan.

Distribution.—*Sorex monticolus parvidens* is restricted to the San Bernardino Mountains and San Gabriel Mountains in southern California (Fig. 9).

Subspecific comparisons and remarks.—Because only six shrews referable to *Sorex monticolus parvidens* were examined, this taxon was not included in the multivariate analysis. This taxon is included in the discussion of geographic variation within the subspecies of *S. monticolus* based on comparisons made among the cranial and mandibular characters and by examination of the summary statistics for univariate characters. In an unpublished report, D. F. Williams (California State College, Stanislaus) indicated that *S. m. parvidens* is a synonym of *S. ornatus ornatus*, but a formal treatment has not been published.

Sorex monticolus prevostensis Osgood

1901. *Sorex longicauda prevostensis* Osgood, N. Amer. Fauna, 21:35, September.
1905. *Sorex obscurus prevostensis* Elliot, Field Columb. Mus., Publ. 105, Zool. Ser., 6:450.
1955. *Sorex vagrans prevostensis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:41, December.
1977. *S[orex]. m[onticolus]. prevostensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 100618, original number 1089; adult male collected 3 July 1900 from "Prevost Island, Queen Charlotte Islands, British Columbia" by W. H. Osgood and E. Heller.

Distribution.—*Sorex monticolus prevostensis* is restricted to Kunghit Island at the southern tip of the Queen Charlotte Islands, British Columbia (Fig. 14).

Subspecific comparisons and remarks.—*Sorex monticolus prevostensis* seems to be allied more closely with *S. m. longicaudus*, *S. m. insularis*, and *S. m. malitiosus* than with *S. m. elassodon*, the subspecies that occurs on the remainder of the Queen Charlotte Islands.

Sorex monticolus setosus Elliot

1899. *Sorex setosus* Elliot, Field Columb. Mus., Zool. Ser., 1:274, May.
1918. *Sorex obscurus setosus* Jackson, Proc. Biol. Soc. Washington, 31:127, November.
1938. *Sorex obscurus mixtus* Hall, American Nat., 72:462. (Type: MVZ 70376).
1955. *Sorex vagrans setosus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:36, December.
1955. *Sorex vagrans mixtus* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:38, December.
1977. *S[orex]. m[onticolus]. setosus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.
1977. *S[orex]. m[onticolus]. mixtus* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—FMNH 6213, adult male collected 18 August 1898 from "Happy Lake, Olympic Mountains, Clallam County, Washington" by D. G. Elliot.

Distribution.—*Sorex monticolus setosus* occurs from approximately Rivers Inlet, British Columbia, east to the Fraser River and southward to Washington where it occurs primarily on the west side of the Cascade Range. *Sorex m. setosus* also occurs in a narrow band near the Columbia River in northwestern Oregon (Fig. 15).

Sorex monticolus shumaginensis Merriam

1900. *Sorex alascensis shumaginensis* Merriam, Proc. Washington Acad. Sci., 2:18, March.
1901. *Sorex glacialis shumaginensis* Elliot, Field Columb. Mus., Publ. 45, Zool. Ser., 2:372.
1902. *Sorex obscurus shumaginensis* Allen, Bull. Amer. Mus. Nat. Hist., 16:228.
1955. *Sorex vagrans shumaginensis* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:42, December.

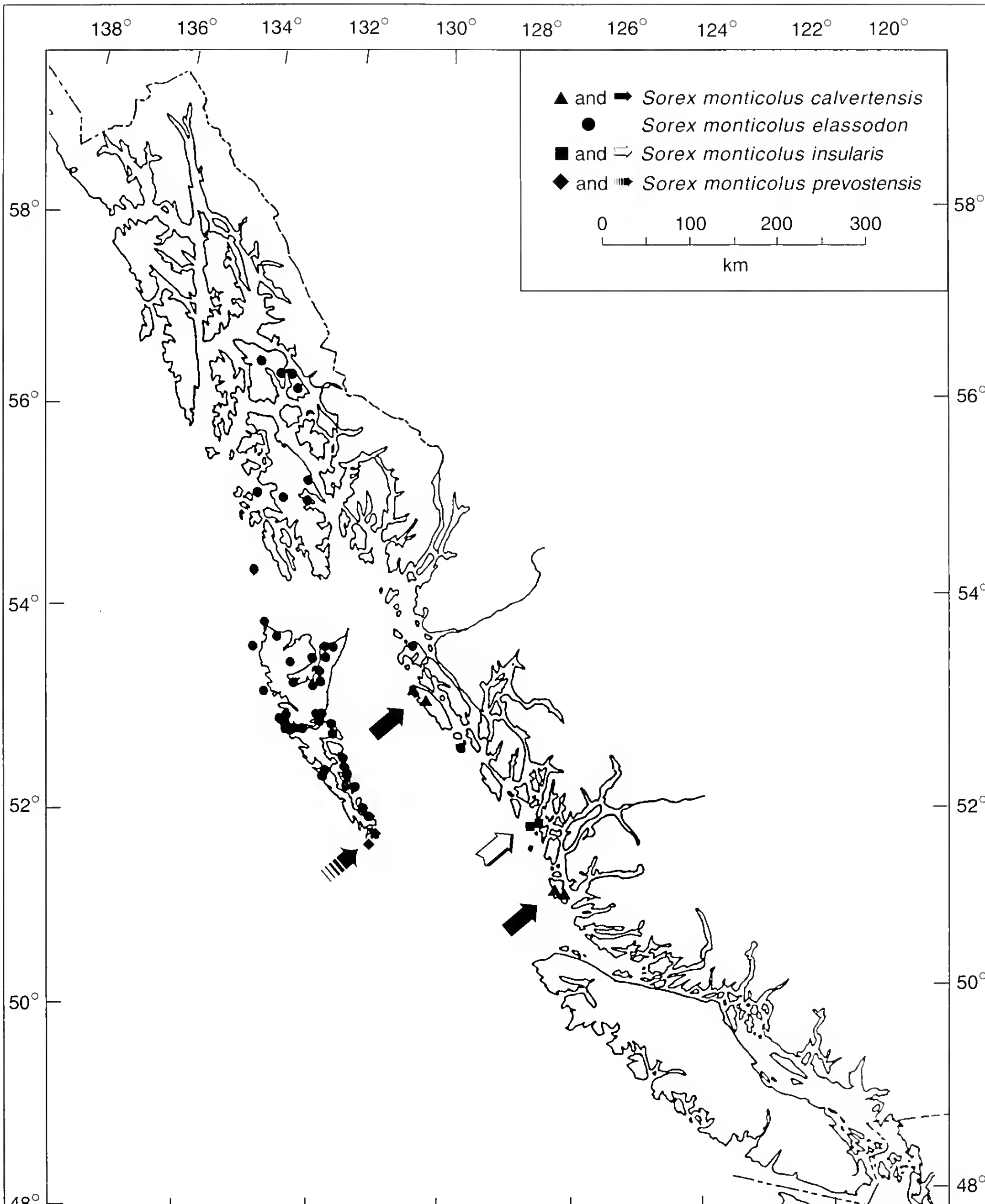


Fig. 14. Distribution of localities for specimens of *Sorex monticolus calvertensis*, *S. m. insularis*, *S. m. elassodon*, and *S. m. prevostensis* included in this analysis representing 5, 3, 55, and 3 unique localities, respectively.

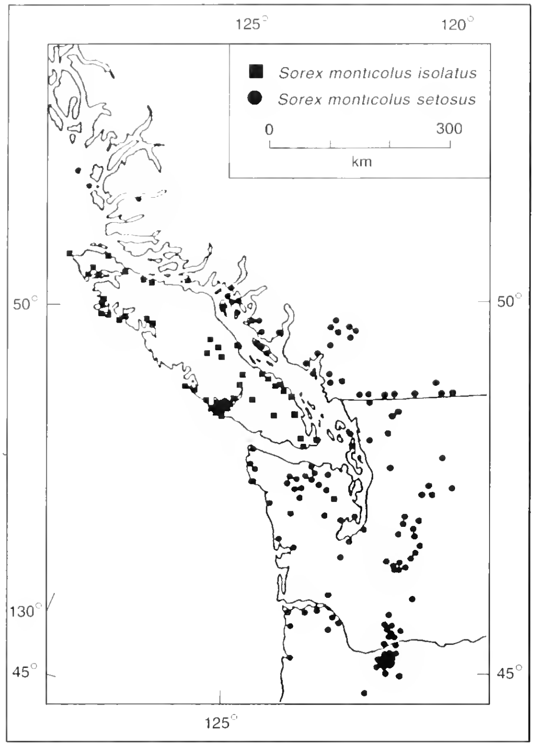


Fig. 15. Distribution of localities for specimens of *Sorex monticolus isolatus* and *S. m. setosus* included in this analysis representing 59 and 150 unique localities, respectively.

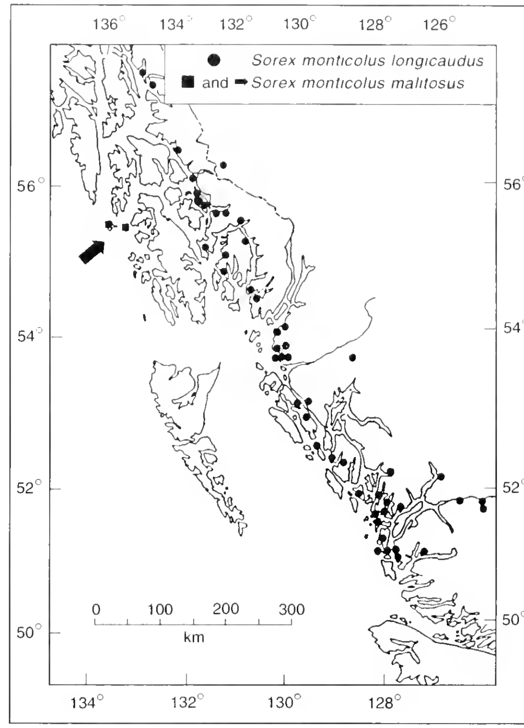


Fig. 16. Distribution of localities for specimens of *Sorex monticolus longicaudus* and *S. m. malitiosus* included in this analysis representing 57 and 2 unique localities, respectively.

1977. *S*[*orex*]. *m*[*onticolus*]. *shumaginensis* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—USNM 97993, original number 2210 (Fisher catalog); adult male collected July 1899 from "Popof Island, Shumagin Islands, Alaska" by D. Saunders.

Distribution.—*Sorex monticolus shumaginensis* occurs in western Alaska from western Prince William Sound, west to the Bering Sea (including the Kenai and Alaska peninsulas), and north to the Noatak Valley in the western Brooks Range (Fig. 13).

Subspecific comparisons and remarks.—Some shrews from the Kenai and Alaska peninsulas had weaker Geisser classifications than those of the mainland populations but remain referable to *Sorex monticolus shumaginensis*. Because peninsular populations are relatively isolated, it is not surprising that these shrews have diverged slightly from those composing the remainder of the mainland population.

Sorex monticolus soperi Anderson and Rand

1945. *Sorex obscurus soperi* Anderson and Rand, Can. Field-Nat., 59(2):47, March–April.

1955. *Sorex vagrans soperi* Findley, Univ. Kansas Publ., Mus. Nat. Hist., 9:48, December.

1977. *S*[*orex*]. *m*[*onticolus*]. *soperi* Hennings and Hoffmann, Occas. Papers Mus. Nat. Hist., Univ. Kansas, 68:4, July.

Holotype.—CMN 18249, original number 4264; adult male collected 21 September 1940 from "2 1/2 miles northwest of Lake Audy, Riding Mountain National Park, southwestern Manitoba, Canada" by J. D. Soper.

Distribution.—*Sorex monticolus soperi* occurs in the vicinity of Prince Albert National Park, Saskatchewan and extends east to include Riding Mountain National Park, Duck Mountain, Porcupine Mountains, The Pas, and Thompson, Manitoba (Wrigley et al., 1979).

Subspecific comparisons and remarks.—Only one unbroken specimen referable to *Sorex monticolus soperi* was examined in this study. The distribution presented is based wholly on published records of specimens (Wrigley et al., 1979). Therefore, the distribution should be viewed as tentative.

DISCUSSION

Sorex neomexicanus was recognized previously as a subspecies of *Sorex monticolus* (Bailey, 1913; Hennings and Hoffmann, 1977), but herein is recognized as a distinct species. *Sorex neomexicanus* occurs in the Sacramento and Capitan mountains, an isolated mountainous region in south-central New Mexico. This region is approximately 282 km south of the known extent of Pleistocene glaciation in New Mexico except for possible glaciation on the highest peak of the Capitan Mountains, Sierra Blanca (Ellis, 1935). It is possible that after the Pleistocene glaciation, southern New Mexico remained as a boreal-forest refugium for *S. monticolus*-type shrews. During the transition to warmer Holocene conditions, lowlands became too arid for these shrews and the populations were isolated in forested, montane regions of New Mexico. The Capitan and Sacramento mountains are sufficiently isolated from other montane regions in the state to reduce or eliminate gene flow between *S. neomexicanus* and *S. monticolus*-type shrews.

Sorex monticolus as defined herein exhibits little morphometric variation in comparison with several nearby congeners (*S. sonomae, S. bairdi, S. pacificus*—Carraway, 1990; *S. bendirii*—Jackson, 1928). Within nominate races, even those widely distributed geographically (e.g., *S. m. obscurus*), coefficients of variation for all characters are ≤7.88 (Table 1). Even among nominate races, the only obvious morphometric variation is a partial south-north cline in greatest length of skull (Fig. 17). There is a general trend of increasing size from south to north. The southern subspecies, restricted to isolated mountains (*S. m. monticolus* and *S. m. parvidens*; Fig. 17), have the shortest skulls of all *S. monticolus* (Table 1). Greatest lengths of skull for these two taxa were significantly shorter than those of all other taxa; they averaged 10% shorter than the taxa with the longest skulls. The subspecies found in the northern coastal and insular areas of southeast Alaska and British Columbia (*S. m. longicaudus* and *S. m. prevostensis*) have the longest skulls (Table 1, Fig. 17). Greatest lengths of skull for these two taxa were significantly greater than those of all other taxa. The remaining subspecies, listed in order of decreasing skull length are *S. m. malitiosus, S. m. insularis, S. m. calvertensis, S. m. alascensis, S. m. elassodon, S. m. setosus, S. m. isolatus, S. m. soperi, S. m. shumaginensis*, and *S. m. obscurus* (Table 1). These taxa do not conform to the south-north pattern of increasing skull length (Fig. 17). Among these groups, the insular taxa tend to have longer skulls (except *S. m. elassodon*) and the mainland taxa tend to have shorter skulls. Two races with long skulls (*S. m. longicaudus* and *S. m. alascensis*) occur on both the mainland and on some islands. In both, the mainland portion of their distribution is restricted to a narrow band along the coast (Fig. 17).

Classical explanations for geographic variation in body size (as herein indexed by greatest length of skull) do not seem to apply completely to *S. monticolus*. Bergmann's rule states that in warm-blooded species, races from colder climates (increased latitude or altitude) tend to be larger than races from warmer climates (Mayr, 1963; McNab, 1971). In some cases this correlation of body size and latitude is a reflection of the size of available prey and is correlated negatively as frequently as it is correlated positively (McNab, 1971). In European shrews (Soricinae), Hanski (1985) found that the most northern species are smaller than southern species; this has been explained by a decrease in

food availability with increasing latitude (Hanski, 1994). Changes in body size of shrews might be a result of interspecific interactions (Hanski, 1994). Four species of coexisting shrews from Alberta, Canada, were separated clearly by body size (Hanski, 1994). In eastern Siberia, where *S. araneus* (a medium-sized shrew) is absent, *S. isodon* (a large shrew in Europe) and *S. caecutiens* (a small shrew in Europe) tend toward the body size of *S. araneus*. Many birds and mammals (especially rodents) also attain a large body size on islands and mountains (Foster, 1964; Grant, 1965; McNab, 1971). These regions typically have a low diversity of species, possibly resulting in less overlap of food niches. The available food might exist in a greater range of food-particle size which would be an advantage for a larger-bodied consumer (Grant, 1965; Hanski, 1985; McNab, 1971). There is much confusion, however, regarding the size of many mammals on islands (Foster, 1964). In a survey of the literature, Foster (1964) found a tendency toward insular dwarfism among carnivores, artiodactyls, and lagomorphs, a tendency toward gigantism in rodents, and no conclusive evidence for other orders of mammals. Among insectivores, Foster (1964) found four species smaller than mainland counterparts, four the same, and one larger. Lawlor (1982) suggested that species of small mammals that are dietary generalists or eat non-particulate food (e.g., vegetation) tend to be larger on islands, whereas species that are dietary specialists or eat particulate food (e.g., seeds) tend to be smaller on islands. Changes in body size (e.g., dwarfism and gigantism) can occur more rapidly on islands than they would on the mainland if the population is relatively small and gene flow is restricted (Foster, 1964).

The pattern of geographic variation observed in the northern half of the range of *Sorex monticolus* is largely consistent with the tendency towards insular gigantism. Except for *S. m. elassodon,* insular taxa are larger than mainland taxa. *Sorex m. elassodon* occurs on the Queen Charlotte Islands and the outer islands of the Alexander Archipelago, but is relatively small; this may be a result of having a comparatively large distribution. If the gene pools for all of the large insular forms are small, it would be possible for a change in body size to occur in a relatively short period of time.

Interspecific interactions probably are not responsible for the larger size of the insular taxa. The only syntopic taxon that might provide interspecific interactions is *S. cinereus;* it is sympatric with *S. monticolus* throughout most of British Columbia and southeast Alaska. *Sorex cinereus* is slightly smaller than *S. monticolus;* the the absence of *S. cinereus* would not result in a shift to a larger size of *S. monticolus* on islands.

Moderate temperatures and abundant precipitation on the coastal islands should favor populations of invertebrates on which soricines feed. According to the hypothesis presented by Lawlor (1982), insular gigantism could result if these shrews are dietary generalists and take advantage of a large variety of available insects. In addition, insular gigantism could be explained by the decrease in predators on islands; small body size is an efficient anti-predator strategy. This also might explain the small size of *S. m. elassodon*; several species of carnivore occupy the Queen Charlotte Islands and presumably prey on these shrews. *Sorex m. shumaginensis* occurs in the northwestern portion of Alaska; its distribution is relatively large and includes interior mainland as well as coastal and peninsular regions. This taxon does not conform to Bergmann's rule but instead remains consistent with the pattern of insular gigantism and smaller shrews in the mainland populations.

The morphometric variation among nominate races is sufficient to warrant continued separation at the subspecies level of all taxa except *Sorex monticolus calvertensis* and *S. m. elassodon.* Were it not for differences in pelage color, based on my morphometric analysis *S. m. calvertensis* and *S. m. elassodon* should be synonymized.

Acknowledgments: I thank B. J. Verts for his encouragement and patience while serving as my major professor. R. A. Pimentel provided assistance with BIOΣTAT. I thank C. W. Alexander, L. N. Carraway, P. M. Harris, D. Nagorsen, R. A. Pimentel, W. P. Stephen, and B. J. Verts for many valuable discussions, and David, Nancy, and Daphne Nagorsen for their hospitality. I also thank my parents for providing financial support during the years of this research.

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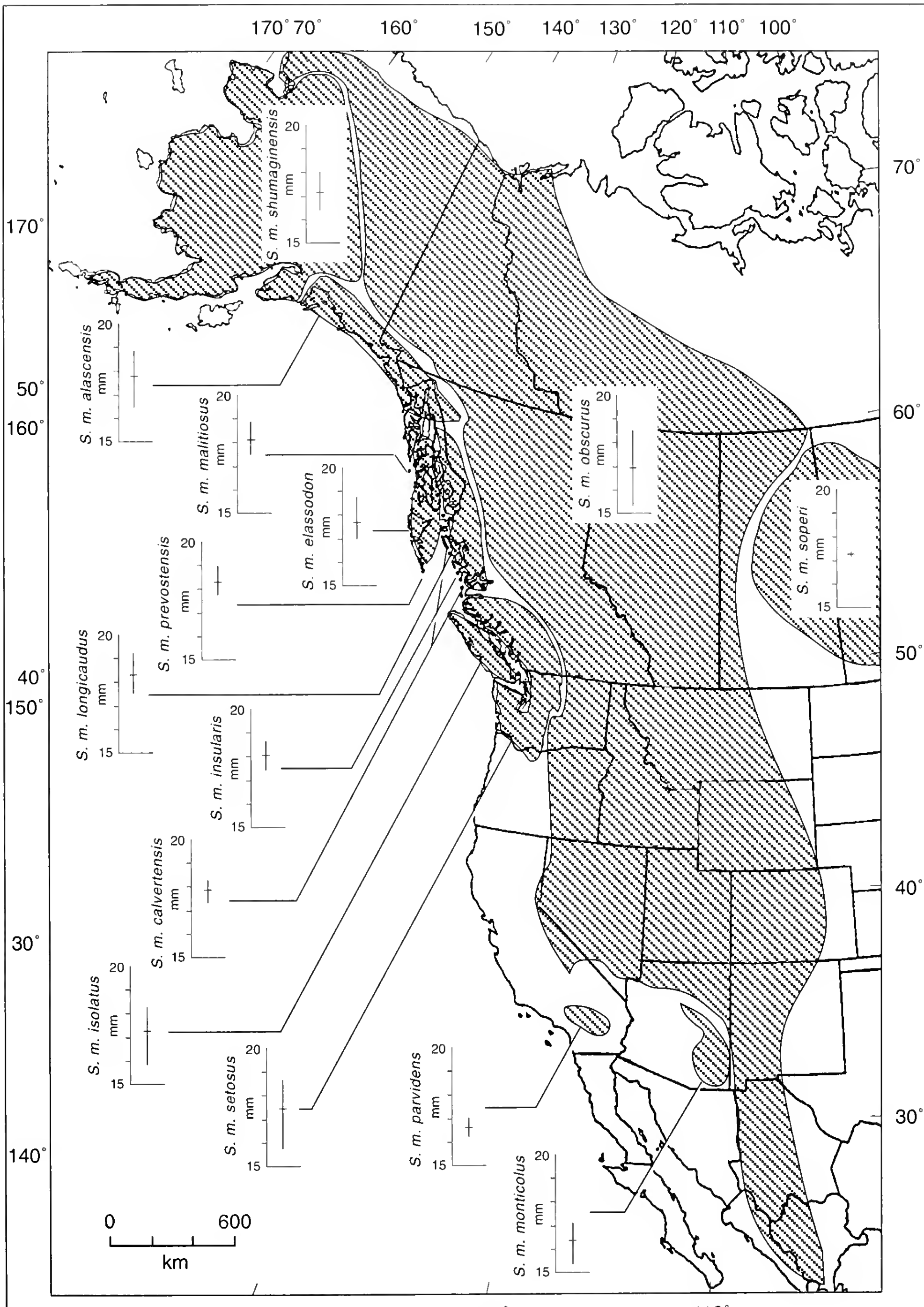

Fig. 17. Mean and range of greatest length of skull for all subspecies of *Sorex monticolus* and the approximate distribution of each subspecies demonstrating the trend of increasing skull length from south to north.

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APPENDIX. SPECIMENS EXAMINED

Abbreviations: Campgnd. = Campground; Ck. = Creek; For. = Forest; Is. = Island; Iss. = Islands; jct. = junction; Mon. = Monument; Mt. = Mountain; Mts. = Mountains; Natl. = National; Pen. = Peninsula; Res. = Reservation; Riv. = River; Stn. = Station; and Val. = Valley. Museum codes are provided in the Acknowledgements.

***Sorex bairdi*.—OREGON** (110): Clackamas Co.: 2 mi N, 4 mi E Sandy, 1 (CRCM 89-1508); 3.5 mi N, 8 mi E Sandy, 1 (CRCM 89-1456); 5 mi S, 6 mi E Sandy, 2 (CRCM 89-1583, 89-3016); 6 mi S, 7 mi E Sandy, 6 (CRCM 89-1532–33, 89-1535, 89-1541, 89-1546–47); 5 mi S, 6 mi E Zigzag, 3 (CRCM 89-1597, 89-1609–10); 9 mi N, 4 mi W Zigzag, 4 (CRCM 89-1678, 89-1684–85, 89-1691); Lane Co.: 1.5 mi N, 2 mi E Blue Riv., 1 (CRCM 89-2668); 2.5 mi S, 7 mi E Blue Riv., 1 (CRCM 89-2858); McKenzie Bridge, 1 (PSM 8115); 4 mi N Nimrod, 2 (CRCM 89-2356–57); T15S, R5E, NW1/4 Sec. 24, 7 (PSM 19870, 19872–73, 19875, 19877–79); T15S, R5E, NW1/4 Sec. 28, 1 (PSM 19701); T15S, R5E, NE1/4 Sec. 32, 14 (PSM 19681, 19684–87, 19689, 19840, 19848–49, 19851–52, 19854, 19856, 19858); T15S, R5E, SW1/4 Sec. 33, 3 (PSM 19767–68, 19774); T16S, R4E, NE1/4 Sec. 24, 3 (PSM 16729, 19738, 19759); T16S, R5E, SW1/4 Sec. 6, 5 (PSM 19690–91, 19693, 19695, 19881); Lincoln Co.: Cascade Head Experimental For., 15 (PSM 4419, 13587–88, 13590–91, 13594–95, 13597, 13726, 13741, 14451–54, 14458); Linn Co.: 7 mi N, 8 mi E Blue Riv., 1 (CRCM 89-1948); 8 mi N, 8 mi E Blue Riv., 2 (CRCM 89-2184–85); 9 mi N, 8 mi E Blue Riv., 3 (CRCM 89-2596–98); T14S, R6E, NE1/4 Sec. 20, 3 (PSM 19816, 19818, 19820); T14S, R6E, NE1/4 Sec. 28, 1 (PSM 19860); T15S, R5E, SE1/4 Sec. 11, 4 (PSM 19835–838); T15S, R5E, SW1/4 Sec. 13, 5 (PSM 19795, 19800–802, 19807); T15S, R6E, NE1/4 Sec. 7, 8 (PSM 19706–708, 19711, 19824, 19829, 19830–831); Trout Ck. For. Camp, T13S, R3E, NW1/4 Sec. 32, 2 (PSM 11974–975); Multnomah Co.: 10 mi N, 10 mi E Sandy, 3 (CRCM 89-1280, 89-1283–84); 10 mi N, 11 mi E Sandy, 1 (CRCM 89-1324); 10 mi N, 1.5 mi W Zigzag, 1 (CRCM 89-1146); Tillamook Co.: 2 mi upstream Miami Riv., 1 (PSM 7003); Netarts, 1 (PSM 3339); Netarts Summit, 1 (PSM 6308); 1 mi E Netarts, 2 (PSM 3341, 3342); Tillamook, 1 (PSM 8116).

***Sorex monticolus alascensis*.—ALASKA** (252): Head of Seymour Canal, Admiralty Is., 1 (UAM 14449); Alaganik, Copper Riv. Delta, Chugach Natl. For., 1 (KU 146138); Alaganik, Pete Dahl Cutoff Cabin, Copper Riv. Delta, Chugach Natl. For., 4 (KU 146131–132, 146134, 146136); Alaganik Cabin, Copper Riv. Delta, Chugach Natl. For., 5 (KU 146119–120, 146122–124); Pete Dahl Cutoff Cabin, Copper Riv. Delta, Chugach Natl. For., 8 (KU 146126–129, OSUFW 7521–524); Million Dollar Bridge, Copper Riv., Chugach Mts., 1 (KU 146139); unnamed creek near terminus Sheridan Glacier, 22 km E Cordova, 4 (UAM 14342, 14344–346); Martin Riv. Slough, 55 mi S Cordova, 2 (CRCM 53-316–317); Coghill Point, Port Wells, 85 mi NW Cordova, 2 (CRCM 53-320, USNM 298425); Eagle Ck., Juneau, Douglas Is., 3 (USNM 290264–265, 290267); Nederstadt-Lindstrom's site, Dry Bay, 4 (CRCM 85-169, 85-341–343); Sandspit 1, Dry Bay, 1 (CRCM 85-344); Sandspit 2, Dry Bay, 18 (CRCM 85-346–351, 85-353, 85-355–356, 85-358–361, 85-363–366, 85-368); Astrolabe Bay, Glacier Bay Natl. Mon., 4 (KU 136812, 136814, 136830, 136843); Bartlett Cove, Glacier Bay, 13 (MVZ 339, 342, 345, 350, 352–53, 357–58, 360, 397, 405–06, 435); Bartlett Cove, Glacier Bay Natl. Mon., 1 (USNM 506565); Boussole Lake, Glacier Bay Natl. Mon., 3 (KU 136818, 136820, 136824); Boussole Muskeg, Glacier Bay Natl. Mon., 1 (KU 136819); Doame Riv. For., Glacier Bay Natl. Park & Preserve, 3 (CRCM 85-403–405); Dundas Bay, Glacier Bay Natl. Mon., 1 (KU 137693); East Riv. Cabin, Glacier Bay Natl. Park & Preserve, 1 (CRCM 85-398); Gustavus, Glacier Bay Natl. Mon., 1 (KU 137692); Point Gustavus, Glacier Bay, 1 (USNM 97709); Inner Point, Glacier Bay Natl. Mon.*, 7 (KU 136804–807, 136809–811); Lester Is., Glacier Bay Natl. Mon., 1 (KU 136836); North of Lituya Bay, Glacier Bay Natl. Mon., 3 (KU 136851, 136858, 137685); south of Lituya Bay, Glacier Bay Natl. Mon., 3 (KU 136854, 136871, 137686); Ranney's Property, Glacier Bay Natl. Park & Preserve*, 3 (CRCM 85-399–400, 85-402); Torch Bay, Glacier Bay Natl. Mon., 12 (KU 136828–829, 136832, 136837, 136841–842, 136861–864, 136873, 137694); Young Is., Glacier Bay Natl. Mon., 1 (KU 136835); 1 mi S Haines, 10 (KU 28499–500, 28502–504, 28506, 28509, 28513, 28516–517); 4 mi N, 9 mi W Haines, east side Chilkat Riv., 8 (KU 28476–478, 28480–481, 28484–495, 28497); 7 mi SSE Haines, Chilkat Pen., 2 (KU 42599–600); 2.0 mi from Bar light, Holkham Bay, 1 (MVZ 112104); Juneau, 24 (USNM 74386, 74388–389, 74391, 74393, 74395–397, 74399, 74690, 97551, 203067, 235774–775, 235780–782, 235784–785, 235790–791, 235794, 235797, 235798); Gold Ck., Juneau, 5 (UIMNH 149–152, USNM 290269); Mendenhall Riv., 1 (USNM 235253); Camp No. 2, Muir Inlet, 2 (USNM 506970–

971); Nunatak Camp, Muir Inlet, 1 (USNM 506972); Orca, 1 (USNM 97991); Head of Cordova Inlet, Prince William Sound, 1 (MVZ 527); Eleanor Is., Prince William Sound, 2 (MVZ 859, 860); North end, Elrington Is., Prince William Sound, 1 (MVZ 710); East end Green Is., Prince William Sound, 1 (MVZ 663); East side of Canoe Passage, Hawkins Is., Prince William Sound, 3 (MVZ 538–39, 543); NE Bay, Hinchinbrook Is., Prince William Sound, 6 (MVZ 571, 573, 596, 604, 927, 940); Galena Bay, Prince William Sound, 1 (CRCM 56-366); Drier Bay, Knight Is., Prince William Sound, 7 (MVZ 781, 790–793, 799, 804); Herring Bay, Knight Is., Prince William Sound, 1 (MVZ 839); La Touche P.O., La Touche Is. [= Latouche], Prince William Sound, 1 (MVZ 948); Hanning Bay, Montague Is., Prince William Sound, 8 (MVZ 635, 642, 644, 648–49, 651–653); Patton Bay, Montague Is., Prince William Sound, 1 (KU 146140); San Juan Bay, Montague Is., Prince William Sound, 9 (KU 146142–143, 146145–151); Zaikof Bay, Montague Is., Prince William Sound, 3 (MVZ 613, 615, USNM 137329); Valdez Narrows, Prince William Sound, 5 (MVZ 884, 895, 901–02, 909); NE end Sullivan Is., 7 (KU 42604–610); Sawmill Bay, Valdez, 3 (CRCM 53-324, USNM 298426–427); Yakutat, 6 (USNM 73532, 73536, 73538, 73541, 73543, 97989); Antler Ck., Yakutat, 1 (CRCM 85-418); Cannon Beach, Yakutat, 6 (CRCM 85-420–425); Yakutat Airport, 3 (CRCM 85-406–407, 85-409); Yakutat Bay, 1 (USNM 73539†); Yakutat Dump For., 7 (CRCM 85-410–413, 85-417, 85-426–427).

***Sorex monticolus calvertensis.*—BRITISH COLUMBIA** (26): Banks Is., 2 (RBCM 4479–480); Larsen Harbor, Banks Is., 9 (RBCM 4469–477); Safety Cove, Calvert Is., 6 (CMN 15130, 15136, RBCM 1947†, UBC 833–34, USNM 287817); 1.5 mi W Safety Cove, Calvert Is., 2 (RBCM 1948, 1959); 5 mi W Safety Cove, Calvert Is., 7 (RBCM 1950–51, 1954, 1956, 1961, 1963, 1965).

***Sorex monticolus elassodon.*—ALASKA** (36): Forrester Is., 1 (USNM 110398); Kupreanof Is., 14 (USNM 126852–854, 127075, 127078–083, 127085, 130837–839); Scow Bay, Kupreanof Is., 1 (USNM 203068); Mitkof Is., 1 (USNM 130834);Petersburg, Mitkof Is., 6 (USNM 126842, 126844–845, 126847–848, 126855); Kasaan Bay, Prince of Wales Is., 8 (USNM 126951, 126953, 126957, 126960, 126962, 127547–549); Klawak Lake, Prince of Wales Is., 1 (USNM 203070); Thorne Harbor, Prince of Wales Is., 2 (UMMZ 106575, 106576); Point Amargura, San Fernando Is., Alexander Archipelago, 2 (UAM 15388–389). **BRITISH COLUMBIA** (142): Estevan Group, Dewdney Is., 6 (RBCM 3135–38, 3140–41); Freeman Pass, Porcher Is., 4 (RBCM 4481–82, 4484–85); Bischoff Is., Queen Charlotte Iss., 3 (UBC 8364, 8413–14); Frederick Is., Queen Charlotte Iss., 2 (UBC 2069, 2229); Tasu Inlet, Gowing Is., Queen Charlotte Iss., 1 (UBC 8411); Graham Is., Queen Charlotte Iss., 1 (RBCM 9811); Bradley's Ranch, Graham Is., Queen Charlotte Iss.*, 2 (UBC 2101–02); Juskatla, [Graham Is.], Queen Charlotte Iss., 1 (UBC 7834); Masset, [Graham Is.], Queen Charlotte Iss., 4 (CMN 3682, UBC 2098, 7799, 8426); Massett [= Masset, Graham Is.], Queen Charlotte Iss., 1 (USNM 35597); South of Masset, [Graham Is.], Queen Charlotte Iss., 10 (RBCM 15236, 15238, 15249, 15263, 15268–69, 15271–73, 15279); Waton Ck., 9 mi S Masset [Graham Is.], Queen Charlotte Iss., 1 (UBC 7781); McClinton County, Graham Is., Queen Charlotte Iss., 4 (USNM 290731–734); Meares Point, Graham Is., Queen Charlotte Iss., 3 (UBC 2091–93); 11 mi N Port Clements, [Graham Is.], Queen Charlotte Iss., 2 (UBC 7726–27); Queen Charlotte, [Graham Is.], Queen Charlotte Iss., 1 (UBC 2105); Skidgate, Graham Is., Queen Charlotte Iss., 1 (USNM 100614); Gold Ck., Tlell-Port Clements, [Graham Is.], Queen Charlotte Iss., 1 (UBC 7869); White Ck., Graham Is., Queen Charlotte Iss.*, 2 (UBC 2094, 2096); Yakoun Riv., Graham Is., Queen Charlotte Iss., 1 (RBCM 9362); Helgesen Is., Queen Charlotte Iss., 5 (RBCM 6527–531); Hibben Is., Queen Charlotte Iss., 2 (UBC 8229, 8440); Hidden Is., Queen Charlotte Iss., 1 (UBC 7930); Hippa Is., Queen Charlotte Iss., 6 (UBC 8175, 8177, 8263, 8266, 8268, 8271); Kunga Is., Queen Charlotte Iss., 2 (UBC 8243, 8262); Langara Is., Queen Charlotte Iss., 2 (UBC 436, 2088); Andrews Point, Langara Is., Queen Charlotte Iss., 1 (UBC 2089); Henslun [=Henslung, Langara Is.], Queen Charlotte Iss., 1 (UBC 8438); Henslung Bay, Langara Is., Queen Charlotte Iss., 20 (UBC 2071, 2073, 2075–76, 2080–85, 2125, 7791–93, 7795, 8203–06, 8439); Skidgate Inlet, Legace Is., Queen Charlotte Iss., 1 (UBC 8410); Lina Is., Queen Charlotte Iss., 1 (UBC 7895); Lyell Is., Queen Charlotte Iss., 1 (UBC 8412); Mackenzie Is., Queen Charlotte Iss., 1 (UBC 2225); Main Bolkus Is., Queen Charlotte Iss., 2 (UBC 7987–88); Maude Is., Queen Charlotte Iss., 1 (UBC 7847); Moresby Is., Queen Charlotte Iss., 2 (UBC 2219, 2221); Cumshewa Inlet, Moresby Is., Queen Charlotte Iss., 20 (FMNH 24279, USNM 100586, 100588–590, 100593, 100595–597†, 100599–0608, 107251); Harriet Harbour, [Moresby Is.], Queen Charlotte Iss., 1 (UBC 7871); Sandspit, Moresby Is., Queen Charlotte Iss., 1 (UBC 2106); Tasu, [Moresby Is.], Queen Charlotte Iss., 4 (UBC 8230, 8264, 8267, 8270); Ogilvie Is., Queen Charlotte Iss., 2(UBC 2222–23); Queen Is., Queen Charlotte Iss., 1 (UBC 2228); Ramsay Is., Queen Charlotte Iss., 8 (UBC 8172–73, 8201–02, 8211–14);

Saunders Is., Queen Charlotte Iss., 2 (RBCM 6534–35); Thurston Harbour, Talunkwan Is., Queen Charlotte Iss., 1 (UBC 7948); Thurston Harbour [Talunkwan Is.], Queen Charlotte Iss., 2 (UBC 8208–09).

***Sorex monticolus insularis*.—BRITISH COLUMBIA** (54): Milbanke Sound, Reginald Is., Bardswell Group, 8 (RBCM 3126–29, 4488–491); Milbanke Sound, Smythe [= Athlone] Is., Bardswell Group, 19 (RBCM 3103–04, 3107, 3109, 3110†–13, 3116–18, 3120–22, 3125, 4496–98, USNM 287819); Milbanke Sound, Townsend Is., Bardswell Group, 27 (RBCM 3082–85, 3087–091, 3093–94, 3096, 3098, 3099, 4501–513).

***Sorex monticolus isolatus*.—BRITISH COLUMBIA** (151): East Bunsby, Bunsby Is., 6 (RBCM 5857–860, 5862, 6245); West Bunsby, Bunsby Is., 3 (RBCM 5863–64, 5867); Little Bunsby Is., 1 (RBCM 5865); Cape Scott, Cox Is., 1 (RBCM 5643); Madigan Farm, Denman Is., 2 (RBCM 13702–703); 3 mi S, 2.5 mi E Post Office, Denman Is., 5 (TCWC 45664, 45667, 45670–671, 45673); Dodd Is., 2 (RBCM 7319–320); South Gibralter Is., 1 (RBCM 8353); Haines Is., 1 (RBCM 7980); Kyuquot Channel, Hohoae Is., 2 (RBCM 6382–83); Jaques Is., 1 (RBCM 8338); Nantes Is., 2 (RBCM 8178, 8401); Nettle Is., 1 (RBCM 8322); Onion Is., 2 (RBCM 8358, 8366); Prideaux Is., 1 (RBCM 8328); Reeks Is., 1 (RBCM 8319); Spring Is., 2 (RBCM 6218, 6220); Turtle Is. Meadow, 6 (RBCM 8214, 8307–308, 8416–17, 8420); Tzartus Is., 2 (RBCM 7203, 7207); Holford Bay, Tzartus Is., 2 (RBCM 7209, 7213); Holford Ck., Tzartus Is., 1 (RBCM 7212); Beaver Ck., Alberni, Vancouver Is., 1 (UBC 6349); Alberni Val., Vancouver Is., 1 (MVZ 12578); Brooks Pen., Vancouver Is., 4 (RBCM 10836, 10838, 10847, 10851); Orchard Point Beach, Brooks Pen., Vancouver Is., 2 (RBCM 10844–845); Phillips Ck., Buttle Lake, Vancouver Is., 1 (UBC 9284); 3.3 mi NW Cowichan Lake [Vancouver Is.], 1 (KU 147128); Comox, Vancouver Is., 4 (CMN 13366–67, 13373, USNM 73705); Dudley Marsh, Vancouver Is., 1 (RBCM 12430); Coombs, Dudley Marsh, Vancouver Is., 2 (RBCM 12777–78); Qualicum Beach, Dudley Marsh, Vancouver Is., 1 (RBCM 12458); Errington, Vancouver Is., 1 (MVZ 12496); Golden Eagle Mine, Vancouver Is., 2 (MVZ 12582, 12585); Goldstream, Vancouver Is., 5 (MVZ 81083, USNM 71911–12, 71914, 71916); SE shore Gooseneck Lake, Vancouver Is., 2 (TCWC 45683–84); 9 mi W Holberg, San Josef Campsite, Vancouver Is., 11 (TCWC 45804–813, 45815); Keogh Riv., Vancouver Is., 1 (UBC 6348); Long Beach, Vancouver Is., 1 (UBC 6346); Long Beach, 6.5 mi S, 8 mi E Tofino, Vancouver Is., 2 (BYU 9700–701); Marble Riv. Recreation Area, Vancouver Is., 14 (TCWC 45364–67, 45816–822, 45880, 45883, 45887); mouth Millstone Ck., Nanaimo, Vancouver Is., 2 (USNM 177720–21); Nanaimo, Vancouver Is., 1 (USNM 177719†); Nanoose Estuary, Vancouver Is., 6 (RBCM 12731, 12747, 12751, 12753, 12765, 12775); Paradise Mine, Vancouver Is., 2 (RBCM 5045, 5047); Parksville, Vancouver Is., 2 (MVZ 12485, 12551); Quatsino, Vancouver Is., 1 (MVZ 77514); Shushartie, Vancouver Is., 1 (CMN 13457); Somenos Lake, Vancouver Is., 1 (RBCM 12523); Sooke, Vancouver Is., 1 (RBCM 11398); 1 mi SE Thomas Point, Vancouver Is., 1 (UBC 6342); 1 mi E Tofino (near Heidlebrand Ranch), Vancouver Is., 1 (UBC 6345); 1 mi SE Tofino, Vancouver Is., 2 (UBC 6343–44); Burnside Road, Victoria, Vancouver Is., 3 (RBCM 11514, 11516, 15826); Mt. Washington, Vancouver Is., 1 (KU 10143); 0.7 mi N Winter Harbour, Vancouver Is., 9 (TCWC 45827–29, 45831–35, 45894); 2.9 mi S Zeballos, Vancouver Is., 3 (TCWC 45846–47, 45902); 4.4 mi N Zeballos, Vancouver Is., 11 (TCWC 45369, 45371, 45836, 45838, 45839, 45842–44, 45898–5900); Wickaninnish Is., 1 (RBCM 6658). **WASHINGTON** (1): Island Co.: Deception Pass State Park, Whidbey Is., 1 (TCWC 45849).

***Sorex monticolus longicaudus*.—ALASKA** (62): Anan Ck., 1 (USNM 217422); Boca de Quadra, 1 (MVZ 8409); Bradfield Canal, 1 (MVZ 8433); Burroughs Bay, 2 (FMNH 21340, 21342); Helm Bay, 4 (MVZ 451–52, 458, 471); 2.2 mi from Bar light, Holkham Bay, 1 (MVZ 112102); Game Management Unit 1, Ketchikan, 1 (FMNH 21341); Loring, 7 (USNM 74906, 74914–15, 74917–18, 74920, 74924); Port Snettisham, 1 (MVZ 8464); Quadra Cannery, 2 (USNM 217416, 526793); Portage Cove, Revillagigedo Is., 2 (MVZ 8419–420); Mouth of Stikine Riv., Sergief Is., 2 (MVZ 30552–53); Thomas Bay, 5 (MVZ 444, 8452, 8455, 8458–59); Wrangell, 23 (USNM 21749, 74691, 74693–95, 74697–99, 74701–03, 74705–09, 74711†–13, 74718, 74908, 74910, UW 2059); Game Management Unit 3, Wrangell, 3 (FMNH 21338–39, 24277); Wrangell Is., 1 (MVZ 8426); Fools Inlet, Wrangell Is., 2 (MVZ 8428–29); Wrangell, Wrangell Is., 3 (MVZ 24562, 24564, 24572). **BRITISH COLUMBIA** (191): Otter Channel, Campania Is., 2 (RBCM 3142, 4514); Ormidale Harbour, Campbell Is., 8 (RBCM 4221–23, 4225–28, 4234); Murder Cove, Chatfield Is., 2 (RBCM 4467–68); Raven Cove, Chatfield Is., 2 (RBCM 4483, 4487); Don Pen., Neekis Riv., 11 (RBCM 4195–96, 4200–01, 4203, 4205–210); Dufferin Is., 3 (RBCM 4235–36, 5425); Joassa Channel, Dufferin Is., 1 (UBC 2768); Hot Springs, Eucott Bay, Dean Channel, 1 (CMN 16592); Fitzhugh Sound, Koeye Riv., 9 (RBCM 3985, 3988–89, 3991, 3993–97); Fitzhugh Sound,

Schooner Pass, 2 (RBCM 1945–46); Fort [= Port] Simpson, 13 (USNM 90200, 90202, 90208, 90210–11, 90213, 90221, 90222, 90225–26, 90229, 90231–32); Grenville Channel, Lowe Inlet, 9 (RBCM 3151, 3154–56, 3159–60, 3165–66, 3168); Hagensborg, Bella Coola Riv., 6 (CMN 15533–34, 15539, 15580, 15803, 15805); Dundivan Inlet, Horsfall Is., 7 (RBCM 4211–15, 4217–18); Hunter Group, B Is., 7 (RBCM 3967–69, 3971–72, 3974, UBC 836); Hunter Group, C Is. [= Ruth Is.], 2 (RBCM 3970, UBC 835); Hunter Is., 2 (RBCM 4008, 4011); Inverness, mouth Skeena Riv., 7 (USNM 90215–16, 90218, 90235, 90236, 90240, 90242); 1.5 mi S Prince Rupert, Kaien Is., 2 (BYU 9698–99); Khutze Inlet, 2 (UMMZ 106581–82); Kimsquit, mouth of Dean Riv., 9 (CMN 16524, 16533, 16547–48, 16733, 16756, 16759, 16766, 16775); west Kinahan Is., 1 (UBC 8850); near Prince Rupert, west Kinahan Is., 1 (UBC 8848); Kynoch Inlet, 5 (RBCM 5426–28, UBC 2766–67); Lakelse Lake, 2 (USNM 290724, 290726); Captain Cove, Pitt Is., 1 (RBCM 4486); Union Pass, Pitt Is., 1 (RBCM 3146); 10 mi E Prince Rupert, 2 (UBC 8845, 8849); 12 mi E Prince Rupert, 2 (UBC 8846–47); Haque Point, Princess Royal Is., 1 (RBCM 3133); Surf Inlet, Princess Royal Is., 1 (UBC 6365); Port Belmont, Surf Inlet, Princess Royal Is., 2 (UBC 6366–67); head of Rivers Inlet, 25 (CMN 15038–39, 15051, 15069, 15072, 15074–76, 15095–96, 15202, USNM 90173, 90175, 90180, 90182–83, 90186–87, 90192, 90195–99, 92805); Spider Is., 24 (RBCM 3978–80, 3983, 3998, 4001, 4003, 4006–07, 4009–010, 4012–18, 4020–22, 4024–25, 4027); Stikine Riv. at Great Glacier, 1 (MVZ 30542); Caribou Mt., near Stuie, 1 (CMN 15674); jct. of Atnarko and Whitewater rivers, Stuie, 3 (CMN 15644, 15651–52); Meyers Pass, Swindle Is., 1 (RBCM 3131); Wigham Cove, Yeo Is., 10 (RBCM 4175, 4177, 4186, 4188–191, 4193, 4492–93).

***Sorex monticolus malitiosis*.—ALASKA** (17): Egg Harbor, Coronation Is., 11 (MVZ 8388–89, 8391–94, 8396–97, UAM 14455–457); East side Warren Is., 6 (MVZ 8398–99, 8400, 8402, 8405–06).

***Sorex monticolus monticolus*.—ARIZONA** (120): Apache Co.: Alpine Job Corp.*, 1 (UIMNH 47103); 4 mi S, 16 mi W Alpine, 6 (MSB 40941, 40944, 40946, 40948, 40992–93); Apache Natl. For., 1 (BSFC 2952); West Fork Black Riv., 1 (MVZ 60377); near head Burro Ck., White Mts., 1 (USNM 209331); Greer, 9 (UIMNH 54033–39, 54041–42); 1 mi S Greer, 1 (UIMNH 54043); Hall Ck., 3 mi N Greer, 1 (UIMNH 50049); Hall Ck., 3.5 mi N Greer, 2 (UIMNH 54031–32); Sheep Crossing, 4.5 mi SW Greer, 6 (UIMNH 54044–49); Phelps Botanical Area, 6.5 mi SW Greer, 1 (UIMNH 54050); Sunrise Lake, 7 mi E Greer, 1 (UIMNH 50050); Phelps Botanical Area, 8 mi SW Greer, 1 (UIMNH 50051); Little Colorado Riv., White Mts., 3 (USNM 158587, 158589–90); Sheep Crossing on Little Colorado Riv., 9 (UIMNH 29058, 29060, 29062–65, 29067, 29069–70); Mount Thomas, White Mts., 1 (USNM 208664); east slope Mount Thomas, White Mts., 2 (USNM 209336–37); Springerville, 1 (USNM 24829); Horseshoe Cienega, White Riv., White Mts., 1 (USNM 209326); Cochise Co.: Fly Park, Chiricahua Mts., 1 (USNM 66090); Long Park, Chiricahua Mts., 1 (UMMZ 77375); Rustler's Park, Chiricahua Mts., Coronado Natl. For., 12 (MSB 40091–93, 40892–93, 40895, 40897, 40899, 47301–04); Coconino Co.: San Francisco Mt., 1 (USNM 17599†); Graham Co.: near head Ash Ck., Graham Mts., 1 (USNM 204189); Hospital Flat, Graham Mts., 1 (UIMNH 4774); Marijilda Canyon, Graham Mts., 1 (MVZ 50249); Snow Flat, Graham Mts., 2 (UIMNH 4775–76); Greenlee Co.: Hannagan Ck., 8 (MVZ 55193–96, 55198–99, 60378–79); Hannagan Meadow, 10 (MVZ 55201, 55203, UIMNH 6037–044); 0.75 mi NE Hannagan Meadow, 2 (UIMNH 6035–36); Horse Cienega, 1 mi NNE Hannagan Meadow, 6 (UIMNH 6028–032, 6034); Lost Lake Road, 1.5 mi N Hannagan Meadow, 2 (UIMNH 6021, 6023); Lost Lake Road, 2 mi N Hannagan Meadow, 2 (UIMNH 6024–25); Cache Cienega, 3 mi SSW Hannagan Meadow, 3 (UIMNH 6045, 6047, 6049); 3 mi S, 2 mi W Hannagan Meadow, 2 (UIMNH 6056–57); 4 mi NE Hannagan Meadow, 3 (UIMNH 6016, 6019–020); Prieto Plateau, South end Blue Range, 1 (USNM 205838); Rose Peak, 1 (MVZ 55189); Navajo Co.: North Fork White Riv., White Mts., 10 (SDNHM 10624, 10658, 10678, 10718, 10725, 10732, 21564–67); Pima Co.: Summerhaven, Santa Catalina Mts., 1 (USNM 244070).

***Sorex monticolus obscurus*.—ALASKA** (57): Alatna, 1 (USNM 245526); Anaktuvuk Pass, 4 (USNM 290246, 290250, 290257, 290258); Bettles, 5 (KU 43198, USNM 245527–29, 245533); Chandler Lake, 1 (KU 43197); Chilkoot Lake, 13.5 km NW Haines, 1 (CMNH 70694); Denali Hwy, east of Maclaren, 63°10' N, 146°30' W, 3 (CMN 40276–78); Denali Hwy, east of Maclaren, 63°08' N, 146°15' W, 3 (CMN 40279–281); Mts. near Eagle, 7 (USNM 130999, 131014, 131029, 131048, 131069–070, 131082); Glenn Hwy, near Eureka Lodge (61°49' N, 147°20' W), 1 (CMN 40282); 1 mi S, 1 mi W Healy, 3 (CMNH 76006–08); Hogatza, 70 mile (Hughes Quad), 1 (UAM 15318); Kilikmak Val., large lake ca. 5 mi NE Kakagrak (headwaters Kilikmak Cr.), 1 (USNM 505019); Mt. McKinley Park, 1 (UBC 3573); Richardson, Tanana Riv., 6 (USNM 234687–88, 234693, 234695, 234698, 241790); Savage Riv., 4 (USNM 244042–44, 244049); Sawtooth Mts., 1 (USNM

245479); Skagway Riv. Val., 4 km NE Skagway, 2 (CMNH 70701, 70703); Tanana Riv., 1 (USNM 38754); Head of Toklat Riv., 8 (USNM 157191–93, 157196–98, 157269, 157271); Wahoo Lake, Brooks Range, 1 (KU 50409); Wells, Chilkat Val., 1 (USNM 217412); Yukon Riv., opposite mouth of Charlie Ck., 1 (USNM 293178). **ALBERTA** (71): Akamina Ck., Waterton Lake Natl. Park, 1 (UBC 1681); Beaverlodge, 55°13' N, 119°26' W, 1 (CMN 51474); Belly Riv., Waterton Lake Park, 1 (CMN 5131); Belly Riv., Waterton Lake Natl. Park, 3 (UAMZ 2830, 3509, 3521); Blakiston Br., Waterton Lake Natl. Park, 1 (UAMZ 3517); Bryant Ck., Banff Natl. Park, 50°52' N, 115°27' W, 2 (CMN 16174, 16179); Cameron Lake W.P. [= Waterton Lake Park], 1 (UAMZ 1388); Cardston, 2 (UAMZ 1368–69); Coleman, Vicary West Ridge, 1 (UBC 8808); 16 mi N Colman [= Coleman], 1 (UAMZ 539); Cottonwood Ck., Jasper Natl. Park, 1 (UAMZ 2832); Crowsnest Pass, 49.4° N, 114.5° W, 1 (UAMZ 1361); Elbow Riv. and Prairie Ck. fork, 1 (CMN 25887); Fiddle Ck., (Ath. [= Athabasca] R.) Jasper Natl. Park, 1 (UAMZ 4007); 7 km S, 5 km W Grimshaw, 56°08' N, 117°41' W, 1 (CMN 51473); Henry House, 2 (USNM 75317–18); 15 mi S Henry House, Rocky Mts., 4 (USNM 81511–12, 92118–19); 20 mi N Hotchkiss, 2 (CMNH 75970–71); Jasper, 1 (CMN 10786); 1 mi N, 10 mi E Kinuso, Assinean Riv., 2 (KU 21079–80); Kvass Summit, 70 mi NW Jasper (by air), 2 (CMNH 22822, 22825); Lost L Ck. x Bauerman Br. Waterton Lakes Natl. Park, 2 (UAMZ 2835, 2842); Maligne Lake, Jasper Natl. Park, 52.4° N, 117.3° W, 4 (UAMZ 4220–23); Medicine Lake, 14 mi S Buck Lake, 52.4° N, 117.1° W, 1 (UAMZ 4707); Muskeg Ck., 15 mi from mouth, 1 (USNM 81353); Muskeg Ck., 20 mi from mouth, 3 (USNM 81359, 81364, 81369); Muskeg Ck., Fishing Lake; 90 mi N Jasper, 1 (USNM 81349); Rock Lake, 6 mi N of NE boundary Jasper Park, 1 (CMNH 22820); Rodent Val., 25 mi W Henry House, 1 (USNM 81373); Slave Lake, 3 (UAMZ 941, 942, 1390); Snaring, Jasper Natl. Park, 1 (UAMZ 2837); Spray Lake, 1 (UAMZ 1366); Sulpher Prairie, 1 (USNM 81401); Sulpher Prairie, Grand Cache Riv., 2 (USNM 81347–48); Sunwapta Pass, Banff Natl. Park, 1 (ROM 22868); N end Tyrell Lake, 1 (UAMZ 5493); Waterton, 4 (UAMZ 557, 1380, 1383, 1385); Waterton Lakes, 1 (ROM 22867); Waterton Lakes Park, 4 (CMN 4654, 4675, 4725, 4734); Waterton Lakes Park, Bertha Ck., 2 (CMN 5087, 5094); Headwaters of West Castle Riv., 2 (UAMZ 6904–05); Whirlpool Riv., Jasper Natl. Park, 3 (UAMZ 2829, 2833–34); Whiskey Gap, 1 (UAMZ 1373). **ARIZONA** (12): Apache Co.: Spruce Ck., Tunitcha Mts., 3 (USNM 227460–61, 227466); Tsaile Ck., 9.5 mi SE Lukachukai, 1 (UIMNH 28431); Wheatfield Ck., west slope Tunitcha Mts., 1 (USNM 247800); Coconino Co.: Baker's Butte, 2 (MVZ 55184, 55187); Double Cabin, 6 mi NW Promontory Lookout, 2 (UIMNH 26319–320); Sawmill Springs, 8 mi SE Mormon Lake, 1 (MVZ 55183); Vincent Ranch, 39 mi S, 16 mi W Winslow, 1 (UIMNH 33552); 28 mi S, 24 mi W Winslow, 1 (UIMNH 33550). **BRITISH COLUMBIA** (151): Akamina Pass, Alberta border, 1 (UBC 3589); Alpha Lake, 1 (UBC 37); Anahim Lake, 1 (UBC 2630); Apex Mountain, 1 (RBCM 7555); Ashcroft, Hat Ck. Val., 1 (RBCM 9587); Atlin Lake, 1 (RBCM 9895); 6 mi N Babine Trail, Babine Mts., 1 (USNM 202800); Barkerville, 3 (USNM 106220, 106222–23); Bear Lake, site of Fort Connolly, 2 (USNM 202802, 202811); Bennett, 4 (USNM 127087, 128208, 128584, 130027); Bennett City, 2 (USNM 99310–11); Buffalo Lake, 1 (RBCM 7556); Burnell Lake, 1 (RBCM 15906); Caraboo Lake, 1 (USNM 67432); Mts. near head Chapa-atan Riv.; near head branch of Stikine Riv., 1 (USNM 170720); Charlie Lake, 2 (RBCM 2589–590); Chezacut Lake, Chilcot, 7 (UBC 6353–56, 6358–360); Chilcotin, Itcha Mtn., 1 (UBC 6351); Dease Lake, 58°27' N, 130°02' W, 1 (CMN 35932); Eutsuk Lake, 1 (RBCM 1715); Fort Grahame, 2 (USNM 170722, 170725); NE Fort Nelson, 1 (RBCM 11324); NE of Fort Nelson, 59°25' N, 120°47' W, 3 (RBCM 11319–320, 11325); E of Fort Nelson, 58°49' N, 121°22' W, 1 (RBCM 11138); Glacier, 4 (USNM 69134–35, 69218, 290716); Golden, 1 (USNM 69141); Haines Road, mile 61, 1 (RBCM 6141); Hazelton, 1 (USNM 202799); Hedley, Stirling Ck., 2 (CMN 8864, 8868); Hope-Princeton Highway, 1 (RBCM 5504); mile 15, Hope-Princeton Highway, 1 (RBCM 5506); mile 20, Hope-Princeton Highway, 1 (RBCM 5505); Hudson's Hope, 1 (USNM 170744); Indian Point Lake, 2 (RBCM 1221, 1224); John Sandy Ck., Pemberton Meadows, 1 (UBC 13308); July Pass, N. Fork Morkill Riv., 40 mi above mouth, near Snowshoe, 3 (CMNH 19628–630); Lac du Bois, Kamloops, 1 (UBC 2673); Kaskonook, Kootenay Lake, 1 (RBCM 5097); 6 mi W Kelly Lake, 1 (UBC 13414); North end Kerry Lake, E bank Crooked Riv., 3 (KU 63902–04); Klappan Riv. Val., Tset-ee-yeh [= Tsetia] Riv., (branch of Klappan Riv.), 1 (USNM 170717); Kootenay Natl. Park, 1 (RBCM 14748); Lac La Hache, 1 (UBC 2633); Laurier Pass, 2 (USNM 256623–24); Link Ck., 1 mi S, 5 mi W LeMoray, 1 (CMNH 75974); Manning Park, Allison Pass, 1 (RBCM 5144); Manning Park, Mountain Beaver Val., 1 (RBCM 5145); Manning Park, Ranger Stn., 5 (UBC 3387, 3394–97); 0.5 mi W Manning Park Lodge, 2 (UBC 9548, 9550); McDame Ck., Dease Riv.; Quartz Ck., 1 (USNM 206099); McDame Post, Dease Riv., 2 (USNM 206103–04); Meziadin Lake, 1 (RBCM 9928);

Meziadin Lake, east side near campground, Nass Basin, 1 (PSM 20929); Monashee Pass, 2 (RBCM 2332, UBC 3741); Moose Lake, 2 (USNM 174412, 174414); Mount Gordon, 3 (RBCM 5509–511); Mount Revelstoke, 1 (USNM 290719); Mount Revelstoke Natl. Park, 1 (USNM 290721); Mount Wardle, Kootenay Natl. Park, 1 (RBCM 14917); North Fork Moose Riv., 1 (USNM 174402); 9 mi S, 44 mi W Muskwa, 2 (KU 63900–901); Nelson, 1 (USNM 69131); 6 mi S Nelson, Silver King Mine, 3 (USNM 66662, 69215–16); 165 mi N of Nelson [= Fort Nelson], Alaska Hwy, 58°51' N, 125°44' W, 1 (CMN 17399); Okanagan, 1 (RBCM 955); Okanagan Landing, 1 (RBCM 921); Omineca Mts., 1 (RBCM 4833); Ootsa Lake, 2 (RBCM 1717–18); Petitot, 59°44' N, 121°51' W, 1 (RBCM 11134); Purden Lake, 35 mi E Prince George, 2 (CMNH 75987–88); Quick, 20 mi E Smithers, 1 (RBCM 9942); Sicamous, 1 (USNM 69319); Smithers, 1600 ft., 1 (TCWC 26980); 10 mi W Smithers, 1 (SUVM 1415); Smoky Riv., 7.5 mi above mouth, near Snowshoe, 1 (CMNH 19626); Spatsizi Plateau, 1 (RBCM 6548); Spout Lake, 1 (UBC 2999); Stikine Riv. at Great Glacier, 1 (MVZ 30546); Cassiar Dist., 5.5 mi W of jct. Stonehouse Cr. and Kelsall Riv., 4 (KU 28534–35, 28537, 28545); Summit Lake, mi 392 Alaska Hwy, 1 (CMN 34554); West end Summit Lake, Alaska Hwy mi 393, 1 (KU 63905); Takla Lake, Omineca Mts., 1 (RBCM 4837); Tats Lake, 11 (RBCM 11668, 11679, 11688, 11704, 11719, 11721, 11728, 11740, 11745, 11746, 11752); Tetana Lake, Driftwood Riv., 1 (RBCM 4648); 3 mi WNW jct. Trout and Liard Rivers, Hot Springs, 1 (KU 28551); 15 mi N, 5 mi E Trutsh, 1 (CMNH 75991); Tutshi Lake, 1 (RBCM 9937); Vermilion Crossing, Kootenay Natl. Park, 2 (USNM 290727, 290728); Vermilion Riv., 30 mi N Radium Hot Springs, 1 (USNM 319523); Whiskers Point, 9 mi S, 6 mi E McLeod Lake, 9 (CMNH 75976–79, 75982–86); Yellowhead Lake, 1 (USNM 174419). **CALIFORNIA** (116): Amador Co.: Silver Lake, 1 (UMNH 13635); Fresno Co.: Bullfrog Lake, 1 (MVZ 24797); Cascade Val., 1 (UIMNH 28283); Charlotte Ck., at Bubb's Ck., 1 (UMMZ 106602); Charlotte Dome, Jesse's Woods, 1 (UMMZ 106594); Cottonwood Basin, 2 (UMMZ 106603, 106605); Grouse Ck., T8S, R25E, Sec. 23, 2 (CMNH 84038, 84039); Horse Corral Meadows, 2 (USNM 42195–96); Kearsarge Lake, 1 (UMMZ 106591); Kearsarge Basin, Kearsarge Lake, 1 (UMMZ 106587); Kearsarge Basin, Kearsarge Ledge Camp, 1 (UIMNH 23550); Kearsarge Basin Ledges, 1 (UMMZ 106601); Russian Tank Camp, 1 (UMMZ 106596); Sierra Nevada Mts., San Joaquin Riv., 2 (USNM 42075, 42078); Inyo Co.: 3 mi S, 8 mi W Big Pine, 1 (MVZ 98945); 7 mi W Big Pine, 2 (RHMC 8166, 8917); 10 mi W Big Pine, 4 (KU 147129–130, 147132–33); 11 mi SW Big Pine, Big Pine Ck. Campgnd., 1 (RHMC 6345); Gilbert Lake, 1 (UMMZ 106586); 1.25 mi S, 5 mi W Independence, 1 (MVZ 98946); near Independence, Little Onion Val., Sierra Nevada, 1 (MVZ 17774); near Independence, Onion Val., Sierra Nevada, 1 (MVZ 17778); Independence Ck., Gilbert Lake, 3 (UMMZ 106585, 106599–6600); Kearsarge Pass, near Independence, Onion Val., Sierra Nevada, 1 (MVZ 17779); Lone Pine Ck., 1 (MVZ 17783); Lone Pine Ck., 1.25 mi S, 9.5 mi W Lone Pine, 2 (MVZ 98947–48); Onion Val., 4 (UMMZ 106583–84, 106597–98); Round Val., 1 (USNM 42411); Sageflat Campgnd., E side Sierra Nevada Mts., Inyo Natl. For., 1 (RHMC 7494); Sierra Nevada Mts., Bishop Ck., 2 (USNM 42070, 42073); Kern Co.: Kern Lakes [= Tulare Co.], 1 (USNM 42410); Onyx, South Fork Kern Riv., 1 (USNM 108815); Madera Co.: Mount Lyell, 6 (USNM 109529, 109533, 110290–92, 116022); Mariposa Co.: East Fork Indian Canyon, 3 (MVZ 22026–27, 22029); Lake Tenaya, 3 (USNM 108936, 110295, 116023); 1 mi E Merced Lake, Yosemite Park, 2 (MVZ 22990, 22999); near Porcupine Flat, Yosemite Park, 3 (MVZ 22032, 22041–42); Mono Co.: Pine City, near Mammoth, 1 (MVZ 32902); Warren Fork of Seevining [= Lee Vining] Ck., 1 (MVZ 23011); Williams Butte, 1 (MVZ 23007); Placer Co.: Robinson Flat Campgnd., T15N, R13E, SE1/4 Sec. 10, 1 (SDNHM 22519); Tulare Co.: Aster Lake, Sequoia Natl. Park, 1 (MVZ 108976); Big Meadows, Sequoia Natl. For., 7 (SDNHM 12007–08, 13573, 13575–76, 13578, 13581); Cahoon Meadow, Sequoia Natl. Park, 3 (MVZ 108977–78, USNM 274873); Halstead Meadows, Sequoia Natl. Park, 1 (USNM 42205); Kaweah Riv., East Fork, 5 (USNM 42303, 42305–07, 42309); Kern Riv., South Fork, 3 (USNM 41630–32); Little Brush Meadow, Olancha Peak, Sierra Nevada Mts., 1 (MVZ 16278); Moltke [= Mulkey] Meadows, Sierra Nevada Mts., 1 (USNM 42739); Mount Whitney, 3 (USNM 42369, 42550–51); Mount Whitney, Whitney Cr., 4 (FMNH 13356–59); Round Meadow, Sequoia Natl. Park, 2 (MVZ 108980, USNM 274874); Sequoia Natl. Park, 1 (USNM 42202); 3 mi SE Three Rivers, 1 (RHMC 7357); Upper Junston Meadow, Kern Riv., 2 (MVZ 108982–83); Tuolumne Co.: Flatcher [= Fletcher] Ck., near Vojeberry Lake, Yosemite Park, 1 (MVZ 22993); Glen Aulin, Tuolumne Riv., Yosemite Natl. Park, 1 (MVZ 23015); near Lyell and Dana Forks Tuolumne Riv., 2 (CMNH 7185, 7207); near Mono Meadow, Yosemite Park, 3 (MVZ 22020, 22024–25); Mount Dana, 1 (USNM 109268); Tuolumne Meadows, N Base Mount Lyell, 1 (USNM 110289); Tuolumne Meadows, Soda Springs, 1 (USNM 108937); Tuolumne

Meadows, Yosemite Natl. Park, 3 (MVZ 22046, 22049, 22054). **COLORADO** (280): Archuleta Co.: 2 mi E, 0.5 mi N Chimney Rock, 1 (MSB 6758); Boulder Co.: Allens Park, 3 (UIMNH 56226–28); 0.75 mi N, 2 mi W Allens Park, 5 (KU 50312–16); Boulder, 2 (FMNH 11672, USNM 112096); 5 mi W Boulder, 1 (USNM 137335); Eldora, 1 (USNM 142519); Longs Peak, at timberline, 1 (USNM 73774); Meadow Mtn., 0.5 mi N, 0.5 mi W Allens Park, 2 (UIMNH 51042, 51044); Nederland, 6 (USNM 137656–57, 142518, FMNH 11665, 11682–83); Ward, 1 (USNM 53941); 3 mi S Ward, 1 (KU 19939); Chaffee Co.: Poncha Ck., 10 mi SW Salida, 5 (KU 113610–11, 113613–15); Saint Elmo, 2 (USNM 150753, 150760); 17 mi W Salida, E side Monarch Pass, 2 (CMNH 15536–37); Clear Ck. Co.: 1 mi SW Berthoud Pass, 1 (BYU 9695); 1013 Griffith Street, Georgetown, 1 (BSFC 10942); Conejos Co.: 5 mi S, 24 mi W Antonito, 1 (KU 41567); Platoro, 6 (FHSU 6819–820, 7164, 7166–68); 3–5 mi SW Platoro, 13 (FHSU 6815–18, 7150–52, 7154–59); Costilla Co.: Fort Garland, 1 (USNM 47269); Delta Co.: Collbran [= Mesa Co.], 12 mi S [= N], 5.5 mi E Skyway, Grand Mesa, 1 (KU 59667); 12 mi S, 5.5 mi E Collbran, Grand Mesa, 2 (KU 59646–47); 0.5 mi S, 8 mi E Skyway, Grand Mesa, 2 (KU 59648, 59650); 1.5 mi S, 8 mi E Skyway, Grand Mesa, 2 (KU 59655, 59665); 2 mi S, 8 mi E Skyway, Grand Mesa, 1 (KU 59653); Dolores Co.: Stoner Mesa, 1 (BSFC 4237); T40N, R13W, Sec. 13, 1 (KU 120928); Fremont Co.: 3.5 mi S Coaldale, 1 (TCWC 4217); Garfield Co.: Baxter Pass, Book Plateau, 1 (USNM 148157); Henderson Ridge, 1 (BSFC 10610); S slope Trapper Ck., 8.5 mi N, 7 mi W Rifle, 2 (BSFC 2174–75); T3S, R93W, Sec. 11, 2 (BSFC 6675–76); Grand Co.: Fraser Experimental For., 3 (BSFC 2915–17); Spruce Ck., Fraser Experimental For., 1 (BSFC 2919); 1 mi N Radium, along Blacktail Ck., 2 (BSFC 6069–070); Gunnison Co.: Beaver Ck., 7.5 mi W Gunnison, 1 (BSFC 24); Calhoun Line*, 3 (USNM 485366–67, 485370); Dry Gulch and Gunnison Riv., 2 (UMNH 17979–80); Gothic, 7 (MSB 9068, USNM 303466–68, 303470–72); 0.25 mi N Gothic, 2 (MVZ 125637–38); 0.3 mi NNW Gothic, 2 (USNM 485303, 485306); 2.7 mi NW Gothic, 2 (USNM 485258, 485310); Gunnison, 7.5 mi W Beaver Ck., 1 (BSFC 1335); 5.8 mi NW Gunnison: Maggie Gulch, 1 (USNM 485288); 1.5 mi N Rocky Mt. Biological Lab., near Gothic, 7 (KU 116710–16); 8 mi NW Sapinero; Black Mesa Experimental Range, 1 (USNM 287590); Willow Ck., 0.5 mi above jct. Gunnison Riv., 1 (UMNH 17981); Huerfano Co.: 4 mi S Cuchara Camp, 2 (KU 68438, 68441); 5 mi S, 1 mi W Cuchara Camp, 8 (KU 59656, 59659–662, 59664, 59669–670); Jackson Co.: 2 mi N, 2 mi E Gould, 1 (KU 116709); La Plata Co.: Columbine Ranger Stn., Cascade Ck., 4 (MVZ 60389–390, 60392–93); Lake Co.: Halfmoon Ck., 8 mi SW Leadville, 3 (KU 113605–07); 12 mi S, 1 mi W Leadville, 1 (KU 57884); 3 mi W Twin Lakes, 2 (KU 57885–86); Larimer Co.: Estes Park, Aspenglen Campgnd., 1 (CMNH 74012); 3 mi S, 3 mi W Estes Park, YMCA Camp, 2 (UIMNH 7558–59); 3.5 mi S, 4 mi W Estes Park Village, 2 (KU 50306, 50309); North Fork Poudre Riv. Campgrd, Roosevelt Natl. For., 1 (BSFC 10783); Sheep Ck., Arapaho-Roosevelt Natl. For., 2 (BSFC 14461, 14817); Sheep Ck., ca. 8 mi N Red Feather Lakes, Arapaho-Roosevelt Natl. For., 10 (BSFC 12625, 12627, 12629–634, 12636, 13495); Willow Park, Rocky Mt. Natl. Park, 7 (UMMZ 57035–36, 57038–39, 57042–43, USNM 293215); Mesa Co.: T5S, R100W, Sec. 35 [= Garfield Co.], 1 (BSFC 10611); Uncompaghre Plateau, Uncompaghre Butte, 1 (USNM 149974); Mineral Co.: Borns Lake, 3 (MVZ 60383–85); Mount McLellan [= McClellan], 2 (USNM 137434–35); 10.3 mi SW South Fork, 1 (KU 147134); 4 mi S, 6 mi E Wagon Wheel Gap, 1 (KU 120929); Moffat Co.: Beaver Ck., 25 mi N, 49.5 mi W Maybell, 1 (FHSU 25125); 1 mi S Craig, 2 (BSFC 4607–08); Maddox Place, Douglas Mt., 3 (BSFC 13069, 13071–72); 22.5 mi N, 49.5 mi W Maybell, 1 (FHSU 25767); 24.5 mi N, 49 mi W Maybell, 6 (FHSU 25763–66, 25770–71); Pool Ck. Ranch, Dinosaur Natl. Mon., 2 (BSFC 13108–09); Streatel Canyon, 1 (BSFC 3578); Tanks Peak, Dinosaur Natl. Mon., 1 (BSFC 12803); Montezuma Co.: 1 mi W Mancos, 1 (KU 75971); Morfield Canyon, Mesa Verde Natl. Park, 1 (KU 75973); Morefield [= Morfield] Canyon, ca. 3 mi S Morefield [= Morfield] Village, Mesa Verde Natl. Park, 8 (BSFC 14216–18, 14221–22, 14229–230, 14232); Prater Canyon, 0.25 mi N Middle Well, Mesa Verde Natl. Park, 1 (KU 69239); Prater Canyon, Upper Well, Mesa Verde Natl. Park, 1 (KU 69238); Montrose Co.: 28 mi SW Delta, head Monitor Ck., 2 (USNM 533010–11); 29 mi SW Delta, Smokehouse Campgnd., 10 (USNM 498400–01, 498403–04, 498406–09, 533007, 533009); 13 mi N, 7 mi E Norwood, 1 (KU 120918); T48N, R14W, SW1/4 Sec. 11, 1 (KU 120921); Ouray Co.: Billy Ck. Wildlife Area, 3 (BSFC 5876–77, 5880); Park Co.: Duck Ck., 8 mi NNW Grant, 2 (BSFC 33, 34); Wilkerson Pass, 9 mi NW Lake George, 1 (TCWC 3917); Rio Blanco Co.: no specific locality*, 1 (BSFC 3011); Avery Lake Meadow, 8 (BSFC 3012, 3017–023); Cb Oil Shale Lease Tr*, 1 (BSFC 2207); Little Hill Res. Stn., 2 mi S, 15 mi W Meeker, 1 (BSFC 2208); 1 mi S, 2 mi W Meeker, 1 (BSFC 2179); Oldland Ranch Spring, 7 mi N, 14 mi W Rio Blanco, 2 (BSFC 5353, 5360); 9.5 mi SW Pagoda Peak, 2 (KU 19933–34); PL Ranch, Wil-

low Ck. Spring, 7 mi N, 16 mi W Rio Blanco, 3 (BSFC 5359, 5361–62); 7 mi N Rio Blanco, 1 (BSFC 3456); 7 mi N, 14 mi W Rio Blanco, 4 (BSFC 5354–56, 5358); Thornburgh Site, 1 (BSFC 3167); Rio Grande Co.: 8 mi S Monte Vista, 2 (UIMNH 33181–82); 8 mi S, 11 mi W Monte Vista, Comstack Campgnd., San Juan Mts., 1 (UIMNH 33180); Rio Grande Wildlife Area, 2 (BSFC 5878–79); Windy Mtn., San Juan Mts., 1 (UIMNH 33187); Routt Co.: no specific locality*, 2 (PSM 12027, 12029); 1 mi N Oak Ck. (town), 1 (BSFC 5413); 1 mi S Slater [= Moffat Co.], 6 (BSFC 4609–614); 3 mi N Steamboat Lake, 2 (BSFC 5415–16); 3 mi N Steamboat Lake, Deep Ck., 1 (BSFC 5417); 3 mi S Steamboat Springs, 3 (BSFC 5419, 5422–23); 3 mi SSW Steamboat Springs, T6N, R84W, Sec. 28, 1 (PSM 12028); 7.9 mi SE Steamboat Springs, 1 (FHSU 17330); Saguache Co.: 5 mi NE Cochetopa Dome, 1 (UMNH 24265); Cochetopa Pass, 2.5 mi E Summit, 2 (MVZ 60381–82); Cochetopa Pass, 33 mi W Saguache, 2 (KU 18206–07); Funk's Meadow, Cochetopa Park and W. Pass Ck., 1 (UMNH 23928); Gold Basin Ck., 10 mi SSE Gunnison, 1 (BSFC 25); Monshower Meadows, 27 mi NW Saguache, 3 mi E Cochetopa Pass, 1 (USNM 48182); 3 mi N, 16 mi W Saguache, 1 (KU 41565); Samora Ck., 0.5 mi from Pass Ck., 2 (UMNH 23930–31); 0.25 mi from Summit, Lujan Ck., 1 (UMNH 23929); San Juan Co.: Silverton, 3 (USNM 56818–820); Summit Co.: 0.5 mi S, 0.2 mi W Loveland Pass, 1 (BYU 9706); 0.75 mi S, 0.75 mi E Loveland Pass,2 (BYU 9709, 9712); Teller Co.: Florissant, 13 mi N Trail Ck., 1 (BSFC 1336); Glen Cove, Pikes Peak, 1 (UMMZ 56308); Trail Ck., 10 mi N Florissant, 2 (BSFC 29, 31). **IDAHO** (39): Adams Co.: 1 mi N Bear Ck. Ranger Stn., SW slope Smith Mt., 1 (KU 45421); Summit of Smith Mt., 1 (KU 45423); 0.5 mi E Black Lake, 1 (KU 45427); Blaine Co.: Alturas Lake, 1 (MVZ 72109); Alturas Lake, 7000 ft., 1 (TCWC 24607); Perkins Lake, Sawtooth Natl. For., 1 (KU 27348); Sawtooth City, 2 (USNM 74999, 75005); Boise Co.: Boise Natl. For., Bald Mt. Riv., 10 mi S Idaho City, 1 (USNM 241793); Bonner Co.: Gold Peak Road, 1 (PSM 3816); Bonneville Co.: 10 mi SE Irwin, 1 (USNM 177269); 8 mi SE Palisades, 1 (TCWC 24604); Caribou Co.: 4.25 mi N, 1.5 mi W Hooper Springs, 1 (FHSU 21948); Custer Co.: Pahsimeroi Mts., 1 (USNM 31942); Fremont Co.: 7 mi W West Yellowstone, 3 (KU 33753–54, 33756); 4 mi N, 17 mi E Ashton, 16 (MVZ 88911, 88913, 88917, 88918, 88920–21, 88924–29, 88931–33, 88935); Idaho Co.: Devils Mts., 1 (USNM 74632); Teton Co.: 3 mi SW Victor, 1 (MVZ 72104); Valley Co.: Salmon Riv. Mt., 1 (USNM 23524); Landmark R.S., Payette Natl. For., 10 mi E Warm Lake, 1 (USNM 265158); Washington Co.: 1 mi NE Heath, SW slope Cuddy Mt., 3 (KU 45429–430, 48121). **MEXICO** (6): Chihuahua, Sierra Madre, near Guadalupe y Calvo, 4 (USNM 95322–24, 95326); Durango, El Salto, 2 (USNM 94539–40). **MONTANA** (82): Beaverhead Co.: Birch Ck., 18 mi NW Dillon, 11 (MVZ 106882–892); Wise Riv., 2 (UMNH 26566–67); Carbon Co.: Beartooth Mountains, 1 (USNM 66710); 8 mi S, 22 mi E Bridger, 1 (KU 136308); Pryor Mountains, 4 (KU 136309, USNM 66489–90, 66501); 2 mi E Shriver, 1 (MVZ 106896); Cascade Co.: Neihart, Little Belt Mts., 1 (USNM 233464); Chouteau Co.: 0.5 mi N Arrow Ck. Divide, Highwood Mts., 1 (KU 83728); Eagle Ck., 25 mi ESE Big Sandy, 2 (UMMZ 87334–35); Highwood Mountains, 6 (USNM 170012–13, 170015, 170021, 170023, 170026); Fergus Co.: Big Snowy Mountains, 2 (USNM 67563–64); Crystal Lake, Big Snowy Mtn., 1 (UMMZ 87324); 5 mi NW Hilger, Mocassin Mts., 1 (USNM 233460); Kendall, North Moccasin Mts., 1 (KU 86103); 7 mi N, 9 mi E Lewistown, 2 (KU 86104–05); Rock Ck., Big Snowy Mtn., 1 (UMMZ 87330); Rocky Ck., Big Snowy Mtn., 1 (UMMZ 87328); Flathead Co.: Gunsight Lake, Glacier Natl. Park, 1 (USNM 244548); Nyack, 2 (UMMZ 75282–83); 2 mi S, 1 mi W Summit, 1 (KU 33758); Upper Stillwater Lake, 1 (USNM 72803); Gallatin Co.: Baker Hole, near West Yellowstone, 2 (CMNH 44786–87); Baker Hole, on Madison Riv., near West Yellowstone, 2 (CMNH 44794, 44801); Beaver Ck. Camp, Madison Riv., 1 (BYU 9713); Gallatin Natl. For., near West Yellowstone, 1 (CMNH 44789); West Fork, West Gallatin Riv., 3 (USNM 226675, 226677, 226679); Glacier Co.: 1.5 mi S, 2.5 mi W Babb, 1 (KU 33757); Crossley [= Cosley] Lake, Glacier Natl. Park, 1 (USNM 246773); Many Glacier, Glacier Natl. Park, 2 (MVZ 88580–81); St. Mary's, Glacier Park, 1 (UMMZ 57957); St. Mary Lake Campgnd., Glacier Natl. Park, 1 (MVZ 126573); Sherburne Lake, Glacier Park, 3 (UMMZ 57960, 57962–63); Hill Co.: head Eagle Ck., Bearpaw Mts., 2 (UMMZ 87337, 87339); Judith Basin Co.: 3 mi W Geyser, 1 (KU 42616); 20 mi SW Stanford, Dry Wolf Ck., Little Belt Mts., 1 (USNM 233463); Lake Co.: Saint Mary's Lake, 4 (USNM 72238–39, 72246, 72489); Madison Co.: 12 mi SW Alder Hinch Ck., Ruby Mts., 3 (USNM 226673, 226678, 226680); Ward Peak, Madison Natl. For., Washington Ck., 1 (USNM 226674); Meagher Co.: 4 mi S Fort Logan, Camas Ck., Big Belt Mts., 3 (USNM 232921, 232924–25); Park Co.: 2 mi NE Cooke, 2 (MVZ 106898–99); Phillips Co.: Zortman, 1 (USNM 169621); Ravalli Co.: 3 mi E Hamilton, 1 (MVZ 99975); 8 mi NE Stevensville, 1 (USNM 168054). **NEVADA** (11): Elko Co.: 22 mi N Deeth, Mary's Riv., 1 (MVZ 67764); 1.25 mi S, 5 mi W Haystack Ranch, 1 (FHSU 20618); South Fork Humboldt Riv., T31N, R36E, Sec. 13, 1 (LACM 74491); South Fork Long Ck., Ruby Mts., 2 (KU

45407–08); 6 mi S, 7.5 mi W North Fork, Independence Mts., 1 (KU 139103); Three Lakes, Ruby Mts., 1 (KU 45411); Eureka Co.: Evans, 1 (MVZ 70521); Humboldt Co.: Summer Camp, Mahogany Ck., 1 (KU 133039); Ormsby Co.: Marlette Lake, 1 (MVZ 67039); 0.5 mi S Marlette Lake, 1 (MVZ 67041). **NEW MEXICO** (145): Bernalillo Co.: 1.2 mi E, 0.2 mi S Sandia Crest Benchmark, Sandia Mts., 1 (MSB 21635); Catron Co.: 19 mi ENE Glenwood, 1 (UIMNH 55932); 10 mi E Mogollon, 2 (FHSU 2925, 8113); 12 mi E Mogollon, 4 (MSB 41359–360, 41367, 41369); West Fork Gila Riv., Mogollon Mts., 1 (FMNH 48101); Willow Ck., 1 (KU 147143); Willow Ck., Mogollon Mts., 1 (USNM 148327); near head Willow Ck., Mogollon Mts., 1 (USNM 158314); between Willow Ck. & Mogollon, Mogollon Mts., 2 (MSB 6958, 6960); Cibola Co.: 4 mi N, 17.5 mi E Grants, T12N, R7W, NW1/4 Sec. 5, 3 (MSB 54673–75); 6 mi N, 14 mi E Grants, T12N, R7W, 4 (MSB 49714–17); Colfax Co.: 1 mi S, 2 mi E Eagle Nest, 2 (KU 41568–69); 1 mi S, 3 mi E Eagle Nest, 4 (FHSU 166, 6635–37); Philmont Scout Ranch, 17 mi NW Cimarron, 1 (USNM 554244); Rio Arriba Co.: Arroyo Yeso, N Ghost Ranch Headquarters, Carson Natl. For., 1 (MSB 20567); 9 mi E, 4 mi N Canjilou, 2 (MSB 6807–08); 6 mi E, 1 mi N Cuba, San Gregorio Lake, Jemez Mts., T21N, R1E, 24 (MSB 15683–86, 15689, 15849–50, 15912, 15915, 15999, 16000, 16629–631, 16648–49, 16768–772, 16785–87); 6 mi E Truchas, 2 (MVZ 116469–470); north slope Truchas Peak, 1 (MVZ 116472); Upper Canjilon Lakes, 1 (MSB 32606); San Juan Co.: North end Chuska Mts., 1 (USNM 158740); Washington Pass, Chuska Mts., 1 (MSB 6896); San Miguel Co.: Gallinas Ck., near Ranger Stn., 1 (MSB 483); Harvey's Ranch, 20 mi NW Las Vegas, Las Vegas Mts., 1 (KU 1754); Sandoval Co.: Fenton Lake, 10 mi N Jemez Springs, 14 (MSB 1941–42, 1944–45, 1948–950, 1952, 1955, 2359–360, 2403–04, 2407); Jemez Ck., 6 mi NW Bland, 5 (MVZ 116333–37); 3 mi N, 8.5 mi E Jemez Springs, Los Conchas, 1 (MSB 37449); 3 mi N, 8.5 mi E Jemez Springs, Los Conchas Campgnd., 2 (MSB 37452, 37457); 3 mi N, 9.5 mi E Jemez Springs, 1 (MSB 43681); 3 mi N, 10.5 mi E Jemez Springs, 4 (MSB 37421, 43703–05); 6 mi N Jemez Springs, 3 (MSB 42328–330); 7.5 mi N, 6 mi E Jemez Springs, 2 (MSB 53599, 53601); 12 mi N, 1 mi E Jemez Springs, 1 (MSB 42312); 12.5 mi N Jemez Springs, Fenton Lake, 1 (MSB 41053); 15 mi N, 2 mi E Jemez Springs, Cibola Ck., 1 (MSB 53715); 16 mi N Jemez Springs, 10 (MSB 41539, 41541–43, 41568, 41574, 41576, 41629–630, 41697); 15 mi S, 5 mi W Los Alamos, Jemez Mts., 1 (MSB 22780); Seven Springs Fish Hatchery, 0.75 mi N, 1.5 mi E Jemez, 1 (USNM 399960); Santa Fe Co.: Hyde Park, 5 mi NE Santa Fe, 1 (UIMNH 7217); 16 mi NE Pojoague, 2 (MVZ 116473–74); Rito Pacheco, Pacheco Canyon, 13 mi NE Santa Fe, 1 (UIMNH 7215); Socorro Co.: Copper Canyon, Magdalena Mts., 1 (USNM 160735); Mill Canyon, Magdalena Mts., 2 (MSB 9678–79); Taos Co.: 3.5 mi N, 3 mi E Arroyo Hondo, D.H. Lawrence Ranch, 2 (MSB 22336, 22368); 4 mi N, 11 mi E Arroyo Hondo, 4 (MSB 41250, 41323–24, 41326); Taos, 1 (USNM 133407); 1 mi N, 2 mi E Tres Ritos, 1 (FHSU 115); 1 mi N, 3 mi E Tres Ritos, 1 (FHSU 8119); 2 mi NE Tres Ritos, Rio La Junta, 2 (MSB 4966, 4969); 4 mi N Tres Ritos, 3 (MSB 966–68); T23N, R3E [= Rio Arriba Co.], 3 (MSB 970–72); Upper LaJunta Campgnd., near Tres Ritos, 1 (FHSU 14891); Torrance Co.: Fourth of July Campgnd., Manzano Mts., 1 (MSB 35351); Red Canyon Camp, 5 mi W Manzano, Manzano Mts., 2 (MSB 16541–42); Red Canyon, 0.5 mi S, 5 mi W Manzano, Manzano Mts., 2 (MSB 7898–99); 6 mi W Tajique on For. Rd 55, Fourth of July Campgnd., 1 (MSB 35359); Valencia Co.: Upper Coalmine Canyon, Mt. Taylor [= Cibola Co.], 1 (MSB 10402); 2 mi NE La Mosca Peak [= Torrance Co.], 3 (MSB 10749, 10761, 10773). **NORTHWEST TERRITORIES** (6): Aklavik, 68°12' N, 135° W, 1 (CMN 24362); Mackenzie, Fort Simpson, 3 (USNM 133746, 133752, 140193); Mackenzie, Mackenzie Riv.; Nahanni Riv. Mts., 1 (USNM 129739); Macmillan Pass, Canol Road, mile 286, 63°20' N, 129°40' W, 1 (CMN 18079). **OREGON** (44): Baker Co.: Anthony, 3 (MVZ 3700, 3705, USNM 154239); Bourne, 1 (USNM 208283); 0.3 mi SE Rock Ck. Butte, Elkhorn Mts., 1 (CRCM 82-16); Grant Co.: 8 mi S, 5 mi W Long Ck., T11S, R31E, Sec. 19, 5 (OSUFW 7335, 7341–42, 7345–46); Malheur Riv., N.F.K., 1 (MVZ 83547); Strawberry Butte, 1 (USNM 79384); Harney Co.: Fish Lake Region, Steens Mt., 9 (OSUFW 7308–310, 7312–16, 7318); 5 mi S, 11 mi E Frenchglen, T32S, R32 3/4E, Sec. 34, 1 (KU 145770); Little Blitzen Gorge, Steens Mt., T33S, R33E, Sec. 10, 2 (OSUFW 4746, 4812); 18 mi N, 4 mi W Riley, T20S, R26E, SE1/4 Sec. 26, 3 (KU 145761–62, ASNHC 8174); Steens Mt., 1 (OSUFW 7570); Steens Mt., T32S, R33E, Sec. 32, 7 (OSUFW 4747, 4749, 4762, 4810, 4815, 4817–18); Steens Mt., T33S, R33E, Sec. 2, 1 (MVZ 119708); Wallowa Co.: 15 mi S, 2 mi E Lostine, T3S, R43E, Sec. 25, 1 (OSUFW 4798); 19 mi S, 4 mi E Lostine, T4S, R44E, Sec. 17, 1 (OSUFW 4799); Wallowa Lake, 3 (MVZ 81067, 81069, USNM 90724); South of Wallowa Lake, Wallowa Mts., 1 (USNM 90756); Wallowa Mts., 1 (USNM 96003); Wheeler Co.: 7 mi S, 11 mi W Mitchell, 1 (MVZ 83542). **SASKATCHEWAN** (4): Cypress Hills, 4 (CMN 19463, 19468, 19473–74). **UTAH** (261): Beaver Co.: Meadow, west and

north Big Flat Guard Stn., Tushar Mts., 5 (UMNH 16455–56, 16458–460); Delano Ranger Stn., Tushar Mts., 4 (UMNH 16463–66); East shore Kents Lake, Tushar Mts., 1 (UMNH 16470); Merchant Ck. at confluence of Crazy Ck., Tushar Mts., 1 (UMNH 16461); Puffer Lake, Beaver Mts., 1 (USNM 158514); Stream side, South of Puffer Lake, Tushar Mts., 2 (UMNH 16467, 16473); CACHE Co.: Cache Natl. For., 1 (SUVM 3452); DAGGETT Co.: Birch Ck., 4 mi S Utah-Wyoming line, 2 (UMNH 20364–65); jct. Deep Ck. and Carter Ck., 1 (UMNH 6071); 15.8 km S Manila, 1 (SUVM 5442); Sheep Ck., Palisade Campgnd., 2 (UMNH 18809–810); East side Spirit Lake, 1 (UMNH 18812); 7.3 km NE Spirit Lake, 2 (SUVM 7130, 7134); DUCHESNE Co.: Anthro Mt., 1 (BYU 10551); Butterfly Lake, 2 (BYU 9696, 9697); Highline Trail, Scudder Lake, 1 (BYU DS4-2#5); Horse Ridge, 1 (BYU 10588); Uinta Park, 1 (BYU 3339); EMERY Co.: Huntingdon Canyon at Corral Ck., 1 (UMNH 13206); Lake Ck., 11 mi E Mt. Pleasant, 2 (CMNH 14206, 14211); Olsen Ranch, Lower Joe's Val., 3 (UMNH 13223–25); near Seely [= Seeley] Mt., 21 mi NE Ephram [= Ephraim, San Pete Co.], 1 (CMNH 14202); Upper Joe's Ranger Stn., 3 (UMNH 13214–16); GARFIELD Co.: E. Fork Boulder Ck., 10 mi N Boulder, 1 (UMNH 9726); Daves Hollow, NW visitors center, Bryce Canyon Natl. Park, 2 (BSFC 13828–29); East Ck. Wells, Bryce Canyon Natl. Park, 4 (BSFC 13291, 13744–46); Griffin Spring, 8 mi NE Widsoe [= Widtsoe], 1 (UMNH 9728); King's Pasture, 10 mi N Boulder, 1 (UMNH 9729); Pine Lake, 6 mi SE Widsoe [= Widtsoe], 1 (UMNH 9109); Round Willow Bottom Res., 10 mi N, 13 mi W Escalante, 1 (UMNH 9054); Steep Ck., 15 mi N Boulder, 1 (UMNH 9091); Upper Val. Ranger Stn., 15 mi SW Escalante, 1 (UMNH 9049); GRAND Co.: Beaver Basin, NW Mans Peak, La Sal Mts., 4 (UMNH 12474–75, 12477, 12480); Beaver Ck., 0.5 mi E Beaver Basin, La Sal Mts., 1 (UMNH 12452); Beaver Ck., 1.5 mi E La Sal Peak, La Sal Mts., 10 (UMNH 12448, 12450, 12456–57, 12459–460, 18949–952); Beaver Ck., 2 mi NE Mt. Waas, La Sal Mts., 4 (UMNH 18932–35); La Sal Mts., 1 (USNM 149971); 1.5 mi E La Sal Peak, La Sal Mts., 1 (UMNH 14289); 2.5 mi NE La Sal Peak, La Sal Mts., 1 (UMNH 14290); Mill Ck., La Sal Mts., 1 (BYU 11590); Pioche Spring, W. Fork Willow Ck., 17 mi N Thompsons, 1 (CMNH 13289); Warner Ranger Stn., La Sal Mts., 3 (BYU 257, UMNH 6680–81); IRON Co.: Brian Head, 1 (BYU 3334); Parowan Mts., Brian Head, 2 (USNM 157954–55); KANE Co.: Yovimpa Pass Meadow, Bryce Canyon Natl. Park, 4 (BSFC 13248–251); MILLARD Co.: Robin's Val., Pavant Range, 5 (UMNH 16448–452); MORGAN Co.: Salt Lake, near summit of Wasatch Mts., 1 (USNM 186694); PIUTE Co.: head of Two Mile Canyon, Tushar Mts., 1 (UMNH 16453); SALT LAKE Co.: Brigham Fork, Emmigration Canyon, 10 mi E Salt Lake City, 1 (UMNH 24020); Brighton, 3 (UMNH 5139–141); 1 mi W Brighton, 1 (UMNH 13603); 1 mi E mouth Little Cottonwood Canyon, 1 (UMNH 9432); 1 mi W Boy Scout Camp, Millcreek Canyon, 1 (UMNH 21707); Mill Creek Guard Stn., Mill Creek Canyon, 1 (UMNH 18362); 2 mi E Mill Creek Guard Stn., Mill Creek Canyon, 1 (UMNH 14168); Spruces, Camp 67, Big Cottonwood Canyon, 1 (UMNH 10699); Wilson Fork, Mill Creek Canyon, 1 (UMNH 9377); SAN JUAN Co.: Cooley Pass, 8 mi W Monticello, 3 (CMNH 15529, 15531, 15533); Horse Ck., La Sal Mts., 2 (BYU 11556–57); Kigalia Ranger Stn., Elk Ridge, 1 (BYU 3378); La Sal Mts., 4 (BYU 11686–89); North Ck., 6 mi W Monticello, 2 (UMNH 12466, 12471); 1 mi S Twin Peaks, Abajo Mts., 1 (UMNH 12472); SANPETE Co.: Ephraim Co., 9 mi E Ephraim, 1 (UMNH 9330); Ferron Reservoir, 28 mi W Ferron, 3 (UMNH 13296, 13298–99); Gooseberry Ck., 1 mi S Lower Gooseberry Reservoir, 5 (UMNH 13198–3202); Indian Spring Ck., above Ferron Reservoir, 2 (UMNH 13210–11); 0.5 mi E Mammoth Ranger Stn., 5 (UMNH 13234–38); Manti, 2 (USNM 186697–98); Mt. Baldy Ranger Stn., 1 (UMNH 9342); Seeley Ck. Ranger Stn., 1 (UMNH 13232); 0.25 mi SW Seeley Ck. Ranger Stn., 1 (UMNH 13204); Straight Fork Pleasant Ck., 9 (UMNH 13239, 13241–42, 13244–47, 13249, 13251); Tom's Hole, 0.25 mi E Seeley Ck., 1 (UMNH 13227); SEVIER Co.: Convulsion Canyon, 41 mi E Salina, 1 (BYU 6629); Fish Lake Plateau, 2 (USNM 157956–57); Hunt's Lake, 2 mi W Monroe Peak, 1 (UMNH 16468); 1 mi NW Mt. Marvine, 1 (UMNH 9433); Rock Spring Ck., Seven Mile Canyon, 1.5 mi N Johnson's Reservoir, 1 (UMNH 9898); 7 [= Seven] mile Ck., 20 mi SE Salina, 4 (CMNH 15513–15, 15517); Seven Mile Ck. Trib., 1.5 mi N Johnson's Reservoir, 3 (UMNH 9379, 9383–84); SUMMIT Co.: Bald Mt., 2 (UMNH 21976–77); jct. Bear Riv. and East Fork, 2 (CMNH 16796–97); 2 mi S, jct. Bear Riv. and Hayden Fork, 1 (CMNH 16801); 4.8 km ENE Bridger Lake, 2 (SUVM 7131–32); Burnt Fork, Round Lake, Uintah Mts., 2 (BYU 11788, 11789); China Meadows Campgnd., 2 (SUVM 5438–39); 0.5 mi S Dahlgreen Camp, 2 (UMNH 21978–79); 8.9 km ESE Kamas, 2 (SUVM 7137–38); Little East Fork, Blacks Fork, 1 (BYU 11825); Little East Fork, East Fork, Blacks Fork, Uintah Mts., 2 (BYU 11781, 11783); 2.25 km S, 2.1 km W Mirror Lake, 1 (SUVM 6501); 13.2 km N, 3.2 km E Mirror Lake, 5 (SUVM 6503–05, 6508–09); 6.9 km N, 13.9 km E Oakley, 3 (SUVM 6499–510, 6596); East Fork, South Fork Uintah Mts., 1 (BYU 11780); TOOELE Co.: Head of Mack Canyon, Stansbury Mts., 3 (UMNH 26368, 26538–39); Right

Fork, Middle Canyon, Oquirrh Mts., 1 (UMNH 26545); Upper Fork Ophir Ck., Oquirrh Mts., 1 (UMNH 26540); South Willow Ck., Stansbury Mts., 1 (UMNH 26577); North slope South Willow Ck., 1 (UMNH 26544); South Willow Ck. Canyon, Stansbury Mts., 4 (UMNH 26370, 26530, 26536–37); 7.5 mi S, 3 mi E Vernon, 1 (BSFC 2735); 10 mi SE Vernon, 1 (BSFC 2733); Right Fork, Vernon Ck. Canyon, Sheep Rock Mts., 1 (UMNH 26542); Uintah Co.: N Fork Ashley Ck., Uintah Mts., 2 (UMNH 26558–59); N Fork Ashley Ck., 1.2 mi E Hacking Lake, 2 (UMNH 26551–52); Blue Mt., Point of Pines Area, 1 (BYU 10822); Head Colton Draw, Colton Ranger Stn., 2 (UMNH 26548–49); Hatch Cabin, 3 mi NE PR Springs, 1 (UMNH 15336); Kaler Camp, 20 mi NW Vernal, 1 (UMNH 26560); East base Leidy Peak, Uintah Mts., 1 (UMNH 26553); Paradise Park, 15 mi N, 21 mi W Vernal, 3 (KU 38030–32); Paradise Park, Uinta Mts., 3 (CMNH 13284, UMNH 6069–070); 17.1 km S Robertson, 4 (SUVM 6631–32, 6634, 6636); Trout Ck., Trout Ck. Ranger Stn., 2 (UMNH 26556–57); Head Trout Ck., 250 yards W Trout Ck. Ranger Stn., 1 (UMNH 26546); Trout Ck. Park, 200 feet E Trout Ck. Ranger Stn., 1 (UMNH 26547); 28.3 km NNE Vernal, 2 (SUVM 5436–37); Utah Co.: 1 mi E Payson Lake, Nebo Mts., 1 (UMNH 7203); Summit Campgnd., 13 (BYU 10164, 10166–69, 10175–76, 10179–180, 10993–94, 10996–97); Wasatch Co.: Bald Mt. [= Summit Co.], 25 mi NE Kamas, 1 (CMNH 13287); Washington Co.: 1.5 mi E Pine Val., 8 (UMNH 21111, 21114–19, USNM 375531); Inlet, Pine Val. Lake, 1 mi E Pine Val., 1 (USNM 375528); Pine Val. Mts., 4 mi E Pine Val., 2 (USNM 166720–21); Pine Val. Mts., 5 mi E Pine Val., 2 (USNM 166716, 166718); Wayne Co.: Aquarius Guard Stn., 10 mi S Bicknell, 1 (UMNH 9724); 1 mi NE Thousand Lake Mts., 1 (UMNH 13733). **WASHINGTON** (49): Asotin Co.: 1 mi S, 11 mi W Anatone, 1 (FHSU 3840); Chelan Co.: head Lake Chelan, 3 (USNM 42244, 42603–04); Cloudy Pass, 1 (CRCM 20); Wenatchee, 1 (USNM 91044); Garfield Co.: Spruce Spring, 1 (PSM 5798); King Co.: Lester, 1 (PSM 10634); Little Eagle Lake, 1 (PSM 10646); Kittitas Co.: Easton, 8 (USNM 41619, 41621–25, 41628–29); 4.5 mi N, 6.5 mi W Easton, 1 (KU 57220); Swauk Cr., Dunning Ranch Trail, 1 (PSM 2094); Lincoln Co.: 12 mi N Odessa, 1 (PSM 4068); Okanogan Co.: Bauerman Ridge, west end at Tungsten Mine, 1 (USNM 235205); E Cirque Slate Peak, 1 (CRCM 82-19); Pend Oreille Co.: Gypsy Meadow, 1 (CRCM 47-143); Pierce Co.: Chrystal [= Crystal] Mt., 1 (PSM 11934); Corral Pass, T18N, R11E, Sec. 30, 1 (PSM 26388); Stevens Co.: Loon Lake, 3 (PSM 2543, 2547, 2849); Spokane Indian Res., 2 (CRCM 86-119–120); Spokane Indian Res., T27N, R37E, Sec. 13, 1 (CRCM 85-791); Spokane Indian Res., T27N, R39E, Sec. 5, 2 (CRCM 85-773, 85-775); Spokane Indian Res., T28N, R38E, Sec. 2, 1 (CRCM 86-60); Spokane Indian Res., T28N, R38E, Sec. 12, 2 (CRCM 86-178, 86-206); Spokane Indian Res., T29N, R39E, Sec. 26, 1 (CRCM 86-26); Spokane Indian Res., T29N, R39E, Sec. 35, 2 (CRCM 86-139, 86-150); Spokane Indian Res., T29N, R40E, Sec. 20, 2 (CRCM 86-77–78); 4 mi N Wellpinit, 1 (CRCM 86-448); 5 mi NE Wellpinit, 3 (CRCM 86-458, 86-609, 86-693); 6 mi NNE Wellpinit, 4 (CRCM 86-351, 86-479, 86-585, 86-602); Moses Rd., 7.5 mi NE Wellpinit, 3 (CRCM 86-403, 86-466, 86-477); 8.5 mi NE Wellpinit, 1 (CRCM 86-354); Cottonwood Rd., 8.5 mi NE Wellpinit, 3 (CRCM 86-561, 86-675, 86-691); S. Cottonwood, 8.5 mi NE Wellpinit, 1 (CRCM 86-419); 9 mi NE Wellpinit, 1 (CRCM 86-676); Yakima Co.: Yakima Indian Res., Signal Peak, 1 (USNM 226855). **WYOMING** (269): Albany Co.: Bear Ck., 3 mi SW Eagle Peak, 2 (USNM 160235–36); Blair Campgnd., 1 (KU 91020); 2.25 mi ESE Browns Peak, 1 (KU 16735); 3 mi ESE Browns Peak, 3 (KU 16747, 16756, 16759); NE Burnett Homestead*, 2 (BYU 9719–720); Foxpark, 1 (UW 2262); 2 mi E Happy Jack Ski Area, 1 (UW 2245); 1 mi E Hidden Val. Picnic Ground, 1 (UW 2265); 4 mi SW Laramie, 1 (KU 91014); 6.1 mi SW Laramie, 1 (KU 91017); 6.5 mi S, 8.75 mi E Laramie, 3 (KU 27688–89, 27691); 9 mi S Laramie, 1 (UW 2428); 11.8 mi S Laramie on 287, Red Buttes Biological Research Facility, 1 (UW 2426); 13.5 km S Laramie on 287, Flag Ranch, 1 (UW 2427); 20 mi SW Laramie, 1 (UW 2247); 26 mi N, 4.5 mi E Laramie, 1 (KU 27686); 26.75 mi N, 4.5 mi E Laramie, 1 (KU 27685); 26.75 mi N, 6.5 mi E Laramie, 1 (KU 27684); 27 mi N, 5 mi E Laramie, 2 (KU 27682–83); 29 mi N, 8.75 mi E Laramie, 2 (KU 27679–680); 30 mi N, 10 mi E Laramie, 3 (KU 27427–29); Lazenby Lake, 10 mi S Laramie, 1 (UW 2248); 0.2 mi N Libby Flats, 2 (BYU 9686–87); 700 ft E Libby Lake Outlet, 2 (BYU 9724, 9725); 0.1 mi S, 0.4 mi E Outlet Libby Lake, 2 (BYU 9689, 9691); Nelson Park, Medicine Bow Mts., 1 (KU 91018); 1 mi ESE Pole Mt., 3 (KU 16763–64, 16766); 2 mi SW Pole Mt., 2 (KU 16723, 16725); 3 mi S Pole Mt., 1 (KU 16732); 1.3 mi SE Pole Mt. Ranger Stn. on Hidden Val. Road, 1 (UW 2249); Red Buttes Biological Research Stn., 1 (UW 2430); S.H. Knight Science Camp, 1 (UW 2235); East slope Sugar Loaf Peak, 2 (BYU 9692, 9693); University of Wyoming Science Camp, 1 (UW 2252); Vedauwoo picnic ground, 1 (KU 91022); 0.2 mi E Vedouwod [= Vedauwoo] Camp, 2 (BYU 9721, 9722); near Wallis Campgnd., Pole Mtn. Div. N.F., 1 (KU 91021); Woods Post Office, 1 (USNM 186693); Big Horn Co.: Big Horn Mts., 1 (USNM 56147); Medicine

Wheel Ranch, 28 mi E Lovell, 8 (KU 32252–53, 32258, 32260–62, 32264, 32268); 1 mi N, 12 mi E Shell, 1 (KU 20906); 4.5 mi S, 17.5 mi E Shell, 1 (KU 19915); head of Trapper's Ck., Big Horn Mts., 1 (USNM 168798); Carbon Co.: Bridger's Pass, 18 mi SW Rawlins, 2 (KU 19937–38); 8 mi N, 14 mi E Encampment, 1 (KU 25219); 8 mi N, 14.5 mi E Encampment, 1 (KU 25231); 8 mi N, 16 mi E Encampment, 3 (KU 25234–36); 8 mi N, 21.5 mi E Encampment, 2 (KU 25252, 25256); 9 mi N, 3 mi E Encampment, 1 (KU 25211); 10 mi N, 12 mi E Encampment, 1 (KU 25196); 10 mi N, 14 mi E Encampment, 3 (KU 25202–03, 25207); Ferris Mts., 4 (USNM 160573, 160581, 160583, 160585); 6 mi S, 14 mi E Saratoga, 1 (KU 25194); Loco Ck., 20 mi W Saratoga, 1 (BSFC 1800); 5 mi N, 10.5 mi E Savery, 1 (KU 25269); 6.5 mi N, 16 mi E Savery, 1 (KU 25265); 7 mi N, 17 mi E Savery, 1 (KU 25263); 8 mi N, 19.5 mi E Savery, 3 (KU 25253–54, 25260); Shirley Mts., 5 (USNM 160241–42, 160244, 160246–47); Sierra Madre Mts., S base Bridger Peak, 2 (USNM 176506, 176508); 1 mi NW Silver Lake, 1 (KU 26687); Trowbridge Ranch, 5 mi SW Encampment, 3 (BSFC 14483, 14485, 14488); Converse Co.: 21 mi S, 24.5 mi W Douglas, 1 (KU 32280); 21.5 mi S, 24.5 mi W Douglas, 4 (KU 32278, 32282, 32286–87); 22 mi S, 24.5 mi W Douglas, 2 (KU 32275–76); 22.5 mi S, 24.5 mi W Douglas, 1 (KU 32281); Northslope Laramie Peak, 4 (USNM 160226, 160229–230, 160232); Springhill, 12 mi N Laramie Peak, 6 (USNM 160215, 160220–160224); Fremont Co.: Bronx, 1 (UMMZ 106644); 17 mi S, 6.5 mi W Lander, 2 (KU 37296–97); Mocassin Lake, 4 mi N, 19 mi W Lander, 1 (KU 32272); Mosquito Park Ranger Stn., 2.5 mi N, 17.5 mi W Lander, 1 (KU 32273); Rattlesnake Mts., 10 (USNM 160255, 160257–59, 160261, 160263, 160266–67, 160269–70); 8 mi E Rougis, Green Mts., 1 (USNM 166869); Sweetwater, near Hwy 187 Fremont Co. border, 1 (UW 1699); Laramie Co.: 4.5 mi E Cheyenne on Herford Road, 2 (UW 2231–32); 1 mi N, 5 mi W Horse Ck. Post Office, 1 (KU 14779); Lincoln Co.: 10 mi SE Afton, Salt Riv. Mts., 3 (USNM 176970–71, 177272); Natrona Co.: 7 mi S Casper, Casper Mts., 2 (USNM 160249–250); 7 mi S, 1 mi W Casper, 1 (KU 27426); Park Co.: Beartooth Lake, 3 (USNM 66713–15); Beartooth Lake, above timberline, 1 (USNM 66718); Beartooth Lake, Shoshone Natl. For., 2 (TCWC 11390–91); Blacktail Deer Ck., Yellowstone Natl. Park, 1 (MVZ 135367); Ishawooa Ck., 19 mi S, 19 mi W Cody, 2 (KU 39402–03); Mammoth Hot Springs, Snow Pass; Yellowstone Natl. Park, 1 (USNM 120590); Mammoth Hot Springs, Yellowstone Natl. Park, 6 (USNM 120591, 120594–98); Needle Mt., 1 (USNM 169316); Needle Mt., tributary of Boulder Ck., 1 (USNM 169507); Pahaska, Grinnell Ck., 3 (USNM 169880, 170102, 170108); Pahaska, mouth of Grinnell Ck., 7 (USNM 169838, 169845–46, 169864–65, 169870, 169881); Pahaska Tepee, mouth Grinnell Ck., 4 (USNM 169849, 169853–54, 170101); Slough Ck., Yellowstone Natl. Park, 2 (MVZ 135368–69); Val., 7000 ft, 1 (USNM 169278); Val., Shoshone Mts., 2 (USNM 169280, 169282); SW slope Whirlwind Peak, 1 (KU 21673); Yellowstone Natl. Park, 2 (USNM 67383, UW 1698); Yellowstone Park, Willow Park, 1 (USNM 66723); Platte Co.: NE base Black Mt., Pat O'hare, 3 (USNM 169124, 169127, 169137); Sublette Co.: North side Half Moon Lake, 1 (KU 14776); 37 mi SE Jackson, 2 (KU 147151–52); 2.25 mi NE Pinedale, 2 (KU 14777, 14778); 12 mi NE Pinedale, Surveyor Park, 1 (USNM 176725); 31 mi N Pinedale, 1 (KU 41557); Sweetwater Co.: Black Rock Ck., 2 mi W Pass, 1 (USNM 170554); Teton Co.: Beaver Dick Lake, Grand Teton Natl. Park, 1 (UMMZ 68085); South Shore Emma Matilda Lake, Grand Teton Mts., 1 (UIMNH 7603); Jackson, Williams Slough, 1 (UMMZ 67553); Jackson Hole Wildlife Park, 11 (USNM 303665, 303667, 303669, 303672–73, 303675, 303677, 303681–84); Jackson Hole Wildlife Park, headquarters, 4 (USNM 303655–57, 303663); Jackson Hole Wildlife Park, 0.5 mi E Moran, 1 (UW 34); Jackson Hole Wildlife Park, 1 mi E Moran, 2 (KU 91011–12); 2.5 mi NE Moose Bar BC Ranch, 1 (KU 32940); 4 mi N Moose Timbered Is., 2 (KU 32938–39); Moran, 5 (KU 16697, USNM 170268–69, 303658, UW 6257); NW Moran, Willows, 1 (UIMNH 7604); 0.25 mi N, 2.5 mi E Moran, 3 (KU 16695–96, 16749); 1 mi N Moran, 1 (USNM 170221); 1 mi S, 3.75 mi E Moran, 6 (KU 16703, 16705–07, 16711–12); 3 mi E Moran, 2 (KU 16751, UIMNH 56453); 3.75 mi E Moran, 1 (KU 16750); Old Faithful, Yellowstone Park, 3 (USNM 246757–58, 246806); Teton Mts., Moose Ck., 2 (USNM 170249, 170252); Teton Mts., south of Moose Ck., 3 (USNM 170320–22); Teton Pass, above Fish Ck., 5 (USNM 170330, 170332, 170335, 170346–47); Whetstone Ck., 3 (UMMZ 62025–26, USNM 249209); Yellowstone Natl. Park, 1 (UMMZ 83653); Uinta Co.: Fort Bridger, 2 (KU 16716–17); 1 mi N Fort Bridger, 1 (KU 16714); 9 mi S, 2.5 mi E Robertson, 1 (KU 25186); 10 mi S, 1 mi W Robertson, 1 (KU 25188); 10.5 mi S, 2 mi E Robertson, 1 (KU 25190); Washakie Co.: 4 mi N, 9 mi E Ten Sleep, 1 (KU 19927); 5 mi N, 9 mi E Ten Sleep, 1 (KU 19925). **YUKON TERRITORY** (54): no locality given, 1 (CMN 29396); Bonnet Plume Lake, 64°20' N, 132° W, 4 (CMN 35252, 35254, 35257, 35259); 5 mi N, 1 mi W Carcross, 1 (CMNH 75972); 20 mi S Chapman Lake, 1 (CMN 33696); 20 mi S Chapman Lake, 64°34' N, 138°15' W,

1 (CMN 29397); 1.5 mi S, 3 mi E Dalton Post, 1 (KU 28524); Dempster Hwy, mile 51, 64°33' N, 138°15' W, 1 (CMN 44986); Dezadeash Lake, 2 (CMN 18184, ROM 16250); Dezadeash Lake, Kluane Natl. Park, 3 (UBC 16531–33); Haeckel Hill, 8 mi NW Whitehorse, 1 (CMN 31153); Haeckel Hill, 60°46' N, 135°17' W, 1 (CMN 37067); Klondike Keno, Keno Hill, 63°55' N, 135°18' W, 1 (CMN 35272); Kluane, 2 (UBC 16130–31); Kluane Range, 25 mi SE Destruction Bay, 1 (CMN 29402); Kluane Range, 25 mi SSE Destruction Bay, 1 (CMN 29403); Little Hyland Riv., 128 mi N Watson Lake, 2 (CMN 31154, 31156); Macmillan Pass, Canol Road, mile 282, 63°12' N, 130°05' W, 1 (CMN 18093); South Fork, Macmillan Riv., Canol Road, mile 249, 62°55' N, 130°30' W, 2 (CMN 18049, 18061); McIntyre Ck., 3 mi NW Whitehorse, 1 (KU 21074); Nisutlin Riv., Canol Road, mile 40, 4 (CMN 17904, 17906, 17924, 17940); North Toobally Lake, 60°20' N, 126°15' W, 1 (CMN 29401); Old Crow, 1 (CMN 29858); Old Crow Mtn. Range, 1 (ROM 74823); Rose [= Ross] Riv., Canol Road, mile 95, 7 (CMN 17797, 17826, 17833, 17846, 17849–851); Rose [= Ross] Riv., Canol Road, mile 95, 61°10' N, 132°59' W, 1 (CMN 17845); Sheldon Lake, Canol Road, mile 222, 2 (CMN 18023, 18024); Slims Riv., Kluane Natl. Park, 1 (UBC 16534); South Moose Ck., 25 mi N, 32 mi E Tuchitua jct. (Cantung), 61°10'30" N, 128°17'0" W, 8 (CMNH 75993–97, 75999–6001).

***Sorex monticolus parvidens*.–CALIFORNIA** (6): Los Angeles Co.: 0.4 mi W Wrightwood, San Gabriel Mts., 1 (RHMC 6423); San Bernardino Co.: Fisherman's Camp on Deep Ck. near Lake Arrowhead, 1 (RHMC 4766); San Bernardino Peak, 1 (USNM 56561†); San Bernardino Peak, Bluff Lake, 2 (USNM 56558, 56559); Summit, 1 (USNM 55550).

***Sorex monticolus prevostensis*.—BRITISH COLUMBIA** (25): Prevost Is. [= Kunghit Is.], Queen Charlotte Iss., 8 (USNM 100611–12, 100615–16, 100618†–19, 107253–54); Kunghit, Queen Charlotte Iss., 1 (CMN 27253); Kunghit Is., Queen Charlotte Iss., 12 (UBC 2109–110, 2112–14, 2117–18, 2120–22, 2130, 2133); Rose Harbour, Kunghit Is., Queen Charlotte Iss., 4 (CMN 30802–03, UBC 7931–32).

***Sorex monticolus setosus*.—BRITISH COLUMBIA** (227): Alpha Lake, Mons, 1 (UBC 6407); Alta Lake, 19 (RBCM 1537, 1539, 1540, 1543, 1549, 2403, UBC 42, 493, 498, 649, 1150, 1845–46, 1849, 1852–53, 6454, 7434–35); Alta Lake, Mons, 27 (UBC 6368–69, 6371, 6373–79, 6381, 6383–86, 6388–399); Sprout Mountain, Alta Lake, 1 (UBC 6406); Bowen Is., 2 (UBC 50, 64); Cortes Is., 2 (RBCM 9621, 12949); Cultus Lake, 1 (UBC 540); 1.5 km upstream from mouth Foley Ck., 1 (RBCM 11022); Black Tusk Meadow, Garibaldi Provincial Park, 1 (UBC 3603); Parnassis Cr., Black Tusk Meadow, Garibaldi Provincial Park, 1 (RBCM 1148); Outlet Green Lake, North Garibaldi Provincial Park, 1 (BYU 9702); Goose Is., 21 (RBCM 3962–65, 5413–18, 5421–23, UBC 2705–711, 2714); UBC Research For., Haney, 6 (UBC 10103, 10107, 10108, 10135, 10143, 10765); Hecate Is., 1 (RBCM 4237); Horseshoe Lake, 3 (CMN 14167, 14183, 14190); 8 mi N Stillwater, Horseshoe Lake, 7 (CMN 14367, 14380, 14516–18, 14529, 14546); Black Mountain, Howe Sound, 1 (UBC 52); Gibson's Landing, Howe Sound, 9 (USNM 90250–51, 90253, 90255–57, 90261, 92806, 92808); Huntingdon, 4 (UBC 56, 416–17, 767); Lesser Garibaldi Lake, 1 (RBCM 6404); Lund, 1 (USNM 92812); Lund, Malaspina Inlet, 5 (USNM 89475, 89479, 89482, 90243, 90249); 3 mi E Lund, Okeover Arm Park, 5 (TCWC 45651, 45654, 45658, 45660–61); Marina Is., 1 (RBCM 12956); Maurelle Is., 1 (RBCM 12962); Mons, 4 (UBC 6400, 6402–04); Nita Lake, 1 (UBC 6409); North Vancouver, 13 (UBC 3713, 3715–16, 3718, 6414, 10088, 10090–91, 10093–97); Makay Ck., North Vancouver, 1 (UBC 48); Port Moody, 7 (USNM 67048, 88838–841, 88853, 88855); Port Neville, 13 (RBCM 9543–45, 9594, 9596–99, 9601, 9605, 9608, 9611, 9841); Powell Riv., 1 (UBC 49); Quadra Is., 2 (RBCM 9151, 9158); Head Rivers Inlet, 17 (CMN 15042, 15050, 15054, 15065, 15070, 15081, 15092, 15189, 15193, 15210, USNM 90174, 90176–78, 90189, 90193, 90428); Thurston Harbor, Sonora Is., 1 (RBCM 12953); Stuart Is., 1 (PSM 15507); Sumas, 4 (USNM 88710, 102676, 102677, 102680); Gillies Bay, Texada Is., 1 (BYU 9703); Texada Is., 2 mi SSE Gillies, Harwood Pt., 3 (TCWC 45679–681); Vananda, Texada Is., 2 (MVZ 70373–74); Vancouver, 3 (CMN 27254, RBCM 1636, UBC 6473); Grantham's Lodge, Vancouver, 8 (UMMZ 106703–710); Point Grey, Vancouver, 10 (UBC 38, 174, 6415–17, 6472, 6475–77, 7436); Stanley Park, Vancouver, 1 (RBCM 5354); UBC Campus, Vancouver, 1 (UBC 8335); UBC Endowment Lands, Vancouver, 6 (UBC 10101, 10117–18, 10125–26, 10129); 23 km E Chilliwack Lake Rd., Vedder Crossing, 2 (RBCM 10879, 11010); Vedder Road, 1 (UBC 8910); Mile 2, Vedder Road, 1 (UBC 8909). **OREGON** (125): Clackamas Co.: 8 mi SE Molalla, 1 (PSM 6244); Still Ck. For. Camp, Mt. Hood Natl. For., 1 (PSM 8632); 2 mi N, 4 mi E Sandy, 5 (CRCM 89-1502, 89-1504, 89-1507, 89-1511, 89-1514); 3.5 mi N, 8 mi E Sandy, 1 (CRCM 89-1457); 3.8 mi N, 8 mi E Sandy, 4 (CRCM 89-1655, 89-1657–89-1659); 4.2 mi N, 8 mi E Sandy, 1 (CRCM 89-1477); 6 mi S, 7 mi E Sandy, 10 (CRCM 89-1534, 89-1536–40, 89-1543–44, 89-1548–49); 5 mi S, 6 mi E Zigzag, 24 (CRCM 89-1575–76, 89-1580,

89-1582, 89-1584–89, 89-1592–96, 89-1598–1601, 89-1604–08); 9 mi N, 4 mi W Zigzag, 12 (CRCM 89-1675–76, 89-1680–82, 89-1686–88, 89-1692, 89-1695–97); Clatsop Co.: Seaside, 1 (PSM 8631); T8N, R7W, NE1/4 Sec. 18, 1 (PSM 26586); T8N, R10W, W1/2 Sec 6, 3 (PSM 26580, 26582–83); T9N, R6W, N1/2 Sec. 19, 1 (PSM 26585); Columbia Co.: 1 mi W Rainier, 1 (PSM 11931); T6N, R1W, SW1/4 Sec. 7, 2 (PSM 26575, 26578); 7 mi NE Vernonia, 1 (PSM 15502); Hood River Co.: 1 mi E Cascade Locks, Oxbow Fish Hatchery, 1 (PSM 6893); Multnomah Co.: 6 mi N, 11 mi E Sandy, 4 (CRCM 89-1435–36, 89-1438–39); 8 mi N, 11 mi E Sandy, 2 (CRCM 89-1168, 89-1170); 9 mi N, 10 mi E Sandy, 4 (CRCM 89-1744–45, 89-1748, 89-1750); 10 mi N, 10 mi E Sandy, 11 (CRCM 89-1263, 89-1267–271, 89-1273, 89-1277–78, 89-1282, 89-1286); 10 mi N, 11 mi E Sandy, 7 (CRCM 89-1330–31, 89-1333–37); 10 mi N, 11 mi E Sandy (3.2 mi SSE Ainsworth Park), 4 (CRCM 89-1322, 89-1325–26, 89-1328); 11 mi N, 10 mi E Sandy, 5 (CRCM 89-1216–220); 11 mi N, 10 mi E Sandy (2.8 mi S Ainsworth Park), 1 (CRCM 89-1215); 8 mi N, 3 mi E Zigzag, 10 (CRCM 89-1388–397); 10 mi N, 1.5 mi W Zigzag, 4 (CRCM 89-1144, 89-1147–49); 11 mi N, Zigzag, 2 (CRCM 89-1196–97); Tillamook Co.: 2 mi upstream Miami Riv., 1 (PSM 7004). **WASHINGTON** (149): Chelan Co.: 22 mi W Lucerne, Lyman Lake, 1 (SDNHM 17023); Wenatchee Lake, 1 (OSUFW 6063); Clallam Co.: Deer Lake, 4 (UMMZ 106622–24, 106627); Canyon Ck., 1 (CRCM 33B); Johnson's Ranch*, 3 (FMNH 6220, 6222–23); La Push, 1 (USNM 89153); Neah Bay, 5 (USNM 88497, 88523, 88527, 88536–37); Olympic Natl. Park, 1 (PSM 25775); Deer Lake, Olympic Natl. Park, 2 (PSM 2164, 2166); Heart O' the Hills Campgnd., Olympic Natl. Park, 3 (PSM 21049–50, 21052); Hurricane Ridge, Olympic Natl. Park, 1 (PSM 3155); Moose Lake, Olympic Natl. Park, 2 (PSM 26396, 28503); Sand Point Trail, Ozette Lake, Olympic Pen., 4 (PSM 1404, 1412, 1421–22); Sol Duc Park, Olympic Natl. Park, 1 (PSM 2890); Ozette Lake, Swan Bay, 2 (UMMZ 106639–40); Port Angeles, 2 (CRCM 573, 5657); Sol Duc Hot Springs, 2 (KU 10718, UMMZ 106636); Cowlitz Co.: Gilbert Lookout, 3 (PSM 11879, 11882, 11885); Grays Harbor Co.: Aberdeen, 1 (USNM 24326); 3 mi S Copalis, Iron Springs, 2 (PSM 1428, 1439); Quiniaielt Lake [= Quinault Lake], 4 (USNM 89636, 89639, 89645, 89647); Jefferson Co.: Blue Glacier, 1 (UMMZ 106621); Jackson Ranger Stn., Natl. For., Hoh Riv., 1 (UMMZ 106620); Kalalock [= Kalaloch], 3 (PSM 2071–72, 2075); Mt. Kimta [= Kimta Peak], 2 (UMMZ 106628–29); Marmot Lake, Olympic Natl. Park, 2 (PSM 3850–51); Rainbow For. Camp, 1 (PSM 3297); Reflection Lake, 2 (UMMZ 106630–31); King Co.: Baldi, 1 (PSM 10654); Lake Keechelus, 1 (UMMZ 57672); Lester, 1 (PSM 10636); Little Eagle Lake, 1 (PSM 13851); Lynn Lake, 1 (PSM 10639); 8 mi SE North Bend, 3 (KU 147159, 147162, 147164); 1.7 mi E Scenic, 2 (KU 147165–66); 8.9 mi W Scenic, 1 (KU 147168); Mason Co.: Detroit, 3 mi SW Allyn, 1 (PSM 984); Lake Cushman, 2 (UMMZ 52905, USNM 66186); Pacific Co.: Fort Canby State Park, 2 (PSM 26573–74); Long Beach, Gile Road, 2 (PSM 1447, 1475); Pierce Co.: Big Ck. For. Camp, 4.5 mi NE Ashford, 3 (UMMZ 88564, 88566–67); Chrystal Mt. [= Crystal], 2 (PSM 11935–36); Corral Pass, 1 (PSM 25777); Corral Pass Campgnd., 1 (PSM 19266); Sunrise Beach Drive, Gig Harbor, 1 (PSM 28509); Longmire, 1 (CRCM 271); 1.5 mi up from Nisqually gate, T15N, R7E, SE1/4 Sec. 33, 1 (PSM 16380); Paradise Ck., Mount Rainier, 1 (USNM 89577); Bench Lake, Rainier Natl. Park, [Lewis Co.] 1 (PSM 16459); Kautz Ck. headwaters, Rainier Natl. Park, 3 (PSM 4279–281); Owyhigh Lake, near outlet, Rainier Natl. Park, 1 (PSM 5941); Tahoma Ck., Rainier Natl. Park, 1 (PSM 4282); Tacoma, 1 (UMMZ 57663); Tacoma headworks, 1 (PSM 13852); Skagit Co.: 0.7 mi NE Rosario Beach, Fidalgo Is., 2 (CRCM 85-592, 85-599); Hamilton, 1 (USNM 24311); Mount Vernon, 5 (USNM 24309, 76318, 76490–491, 88808); Skamania Co.: 5.5 mi N, 6.5 mi W Carson; T4N, R7E, NE1/4 Sec. 33, 5 (KU 145774–77, 145779); 5.5 mi N, 7.5 mi W Carson; T4N, R7E, E1/2 Sec. 32, 6 (KU 145782–87); 8 mi N, 8 mi W Carson; T4N, R7E, N1/2 Sec. 20, 5 (KU 145788–790, 145792, 145794); 10 mi N, 2 mi W Carson; T4N, R8E, SW1/4 Sec. 7, 6 (KU 145797–5802); 11 mi N, 9.5 mi W Carson; T5N, R6E, NW1/4 Sec. 25, 7 (KU 145804–09, 145813); 12 mi N, 9.5 mi W Carson; T5N, R6E, N1/2 Sec. 24, 3 (KU 145815–16, 145818); 13 mi N, 8.5 mi W Carson; T5N, R7E, N1/2 Sec. 18, 2 (KU 145819–20); 44 mi N, 9.5 mi W Carson; T7N, R6E, SW1/4 Sec. 12, 10 (KU 145821–830); Council Pass, 1 (PSM 1396); 5 mi N Skamania, 1 (CRCM 82-462); Snohomish Co.: Granville, 1 (USNM 89651); 3 mi up Rapid Riv. from Beckler Riv., 1 (PSM 14146); Thurston Co.: Tenino, 1 (USNM 89649); Whatcom Co.: Mt. Baker, 1 (CRCM 58); Skyline Ridge, Mt. Baker, 1 (CRCM 51).

***Sorex monticolus shumaginensis*.—ALASKA** (194): Lake Aleknagik, 1 (USNM 224892); Peters Ck., 20 mi NE Anchorage, 1 (KU 42598); Conner's Lake Bog, Raspberry Road, Anchorage, 1 (MVZ 162064); Aniak, 1 (USNM 180429); Anuk Lake, Noatak Val., eastern most lake, headwaters Kaluich Ck., 1 (USNM 505018); Becharof Lake, Alaska Pen., 7 (USNM 119638, 119641–42, 119644–47); Campbell Klatt Bog, 300 m SE Klatt Rd & Victor Rd jct., Anchorage, 2

(MVZ 162066–67); Chignik, 2 (USNM 159542, 179961); Chignik, upper Lake, 1 (USNM 176657); Chignik, Chignik Bay, 1 (USNM 176658); Cold Bay, Alaska Pen., 8 (USNM 119656–58, 119661–62, 119664, 119666, 120031); Fishhook, 3 (CMN 40283–85); East base Frosty Peak, Alaska Pen., 9 (USNM 177036–38, 177041–42, 177045–47, 177219); Halibut Cove, Kachemak Bay, Cook Inlet, 1 (UIMNH 17912); Hazen Point, Izembek Bay, 2 (USNM 246471, 246477); Hope, Cook Inlet, 8 (USNM 107135, 107139, 107141, 107143, 107145–46, 107153, 107156); near Hope, 5 (CMN 40286–290); mountains near Hope, Cook Inlet, 4 (USNM 107105, 107107, 107111, 107155); Iliamna, 1 (CMNH 62274); Kakhtul Riv., 4 (USNM 119723, 119726–27, 119732); Kanatak, Portage Bay, Alaska Pen., 2 (USNM 119649, 119652); King Cove, Alaska Pen., 11 (USNM 177020–22, 177025, 177027–28, 177213, 177301, 177305–07); Kokwok, Nushagak Riv., 2 (USNM 119668, 119670); 80 mi upstream Kokwok, 1 (USNM 180561); Morzhovoi Bay, Alaska Pen., 4 (USNM 177030–31, 177034–35); Ninilchik, 22 (CMNH 76010–12, 76015–17, 76020–035); Nome, 1 (SDNHM 46); Nushagak, 13 (USNM 119678, 119683, 119685–87, 119691–94, 119696–99); Pedro Bay, 3 (CMNH 62278–280); Pilot Stn., Yukon Riv., 2 (UIMNH 53554–55); Popof Is., 3 (TCWC 20639–640, USNM 273099); Popof Is., Shumagin Iss., 1 (USNM 97993†); Sanak, 1 (USNM 273096); Sanak Is., 1 (USNM 263300); Sapsuk Riv., Alaska Pen., 3 (UAM 13767, 13773, 13775); Sapsuk Riv., Port Moller Quad, Alaska Pen., 5 (UAM 13760–62, 13765, 13771); Scammon Bay, 2 (CMNH 70695–96); Seward, 7 (CMNH 62275–76, USNM 273092–94, 273100–101); 13 km NW Seward, Kenai Pen., 1 (CMNH 60950); Mountain Climber Roadhouse, Skwentha Riv., 1 (USNM 242751); 6 mi WSW of Snowshoe Lake, 1 (KU 21070); 2 mi W Soldotna, Kenai Pen., 2 (CRCM 80-27, 80-753); Upper Susitna Riv., Talkeetna Mts., 1 (UAM 13717); Upper Susitna Riv., Devil's Canyon area, Talkeetna Mts., 1 (UAM 14802); Upper Susitna Riv., Tsusena Ck. area, Talkeetna Mts., 3 (UAM 14801, 14803–04); 7 mi N, 4 mi W Talkeetna, 10 (CMNH 76036–39, 76042, 76044–48); Tyonek, Cook Inlet, 2 (FMNH 24280–81); Tyoonok [= Tyonek], Cook Inlet, 21 (USNM 107049–051, 107053–56, 107063, 107065–68, 107114–17, 107121, 107123–24, 107202–03); Ugaguk [= Egegik] Riv., Alaska Pen., 1 (USNM 119636); Unga, Unga Is., 1 (USNM 177300); Urilia Bay, Unimak Is., 1 (USNM 246467); Cottonwood Ck., 1 mi SE Wasilla, 1 (UMNH 28197).

***Sorex monticolus soperi.*—SASKATCHEWAN** (1): Spruce Riv., 1 (UAMZ 1363).

***Sorex neomexicanus.*—NEW MEXICO** (46): LINCOLN CO.: Capitan Mts., 3 (MSB 4755–57); southwest slope Capitan Mts., 1 (USNM 128188); 5 mi W Alto, 3 (MSB 16561–62, 18970); OTERO CO.: Cloudcroft, 3 (USNM 100440†–42); 1 mi S Cloudcroft, 1 (FHSU 5435); Deer Head Campgnd., 1 mi S Cloudcroft, 1 (RHMC 7492); 2 mi N Cloudcroft, 1 (MSB 18043); 3.2 mi E (by road) Cloudcroft, 6 (MSB 37327–330, 37340–41); 5.5 mi NE (by road) Cloudcroft, 22 (MSB 37343, 37345, 37347–357, 37359–360, 41069, 41071, 41078, 41081, 41084, 41086–87); Silversprings Ck., 5.5 mi NE (by road) Cloudcroft, 2 (MSB 41056–57); 10 mi NE Cloudcroft, 3 (USNM 118789–791).

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